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OU III AR 569a

Department of Energy

Grand Junction Projects Office
Post Office Box 2567
Grand Junction, Colorado 81502-2567

July 21, 1989

Mr. Lam Nguyen
Remedial Project Manager
U. S. Environmental Protection Agency
Region VIII
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Robert McLeod
Bureau of Solid and Hazardous Waste
288 North 1460 West
P. O. Box 16690
Salt Lake City, UT 84116-0690

Subject: The Department of Energy (DOE) Position on the Resource Conservation and Recovery Act (RCRA) Relevance and Appropriateness to Monticello Remedial Action Project (MRAP) and the Monticello Vicinity Properties (MVP) Mill Tailings

Dear Sirs:

The DOE has received your comments (L. Nguyen to D. Williamson letter dated June 22, 1989 and Bradford to Nguyen letter dated June 21, 1989) on our Applicable, Relevant and Appropriate Requirements (ARARs) submittal for the MRAP and MVP and have several concerns which need to be resolved. Our major concern reflects a substantial difference between DOE and the Environmental Protection Agency/State of Utah (EPA/Utah) concerning the requirements, specifically RCRA, that will govern the conduct of these projects. Your letter stated that RCRA should be relevant and appropriate because the tailings are similar to a hazardous waste in that they contain heavy metals. As negotiated during the Federal Facility Agreement process, EPA's Uranium Mill Tailings Radiation Control Act (UMTRCA) regulations in 40 CFR 192 establish the appropriate technical standards for these projects. In addition, EPA proposed Remedial Action Standards at Inactive Uranium Process Sites (52 FR 36000-36008, September 24, 1987) incorporates the appropriate RCRA requirements including groundwater protection standards in 40 CFR 264.92, 264.93, 264.94 and 264.95, and closure performance standards in 264.111. Additionally, monitoring activities for a period of time comparable to that given in 40 CFR 264.117 are required during the post-disposal period, and requirements for corrective action programs (similar to 40 CFR 264.100) are given in the proposed UMTRCA regulations.

In addition to the above requirements for protection from non-radioactive constituents, 40 CFR 192.02 provides additional protection standards and requirements for the control of radiological hazards that are not addressed by RCRA.

The mill tailings, which contain various naturally occurring heavy metals, do not contain RCRA hazardous wastes as identified in 40 CFR 261. The mere presence of heavy metals in the mill tailings should not make the tailings similar to a RCRA hazardous waste. It is our interpretation that the Extraction Procedure (EP) toxicity test is designed to specifically identify non-listed RCRA hazardous wastes. (See Preamble discussion 43 FR 33110, May 19, 1980). The test recognizes that the availability of the heavy metals to the environment, not their presence, is the primary concern in determining whether a waste is hazardous. We believe that this test removes any ambiguity of whether a waste is "similar" to a hazardous waste. As stated in the ARARs analysis, mill tailings, that are similar in nature to Monticello's, have been subjected to the EP toxic test and have passed (*Draft Final Grand Junction Projects Office Remedial Investigation, DOE/ID/12584-16, April, 1989, U.S. Department of Energy*).

The draft MRAP RI identifies the heavy metals and their concentrations found in the Monticello Mill Tailings (Chapter 3.2.3). All are naturally occurring and are not a result of the milling process. Some metals exist in concentrations similar to mineralized sandstone, some in quantities similar to uranium ores, and a few heavy metal concentrations in the tailings are elevated due to the ore refining process. Given the fact that these metals are naturally occurring and can be shown to not be available to the environment in quantities exceeding regulatory limits using the EP toxicity test, we do not understand the basis for the EPA/State position that RCRA be an ARAR for the mill tailings. We request that the basis for EPA's and the State's conclusion that the tailings are similar to a hazardous waste and that RCRA should be an ARAR, be clarified and provided for our review. Given the August 28 deadline for issuing the draft RI/FS to the public, and in order to avoid any schedule extensions, we need an immediate resolution to this issue.

We plan to submit our other concerns mentioned earlier in a separate letter to avoid confusing the issues. Please realize that DOE is not proposing that RCRA would not apply if a separate RCRA hazardous waste, not previously anticipated, was discovered.

If you have any questions or wish to set up a meeting, please contact me at (303) 248-6009.

Sincerely,

Dee J. Williamson
Monticello Project Manager
Grand Junction Projects Office

cc: WE Murphie - NE-23/GTN
A Feldt - EH-232/FORS
S Miller - GC-11/FORS
B Mathis/MRAP file
C Nichols - DOE/ID
R Throckmorton - DOE/ID

[redacted]-4-52

Department of Energy
Grand Junction Projects Office
Post Office Box 2567
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SEP 16 1992

Mr. Paul Mushovic
EPA Region VIII
Suite 500, Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, Colorado 80202-2405

Mr. Brent Everett
State of Utah
Department of Environmental Quality
Bureau of Env. Response & Remediation
1950 West North Temple
Salt Lake City, Utah 84116

SUBJECT: Transmittal of the Final Surface- and Ground-water Remedial Investigation/Feasibility Study Documents

Dear Mr. Mushovic and Mr. Everett:

Enclosed are four copies of the final Surface- and Ground-Water Remedial Investigation/Feasibility Study Work Plan, Field Sampling Plan, and Quality Assurance Project Plan for Phase I. As discussed, the responses to comments made by the Environmental Protection Agency (EPA) and the State of Utah have been incorporated into the texts as appropriate. Specific responses to comments are provided in the Comments Response Sheets which are also enclosed.

Please remove and destroy the draft versions of the documents currently in your notebooks and replace them with these final copies. Also, please sign and return the "Manual/Plan Transmittal" form to Chem-Nuclear Geotech's Records Management Section. Drilling mobilization will begin on September 16, 1992, with actual drilling scheduled to begin on September 19, 1992.

If you have any questions on the enclosed information, please call me at (303) 248-6197.

Sincerely,

Tracy B. Plessinger

Tracy B. Plessinger
Project Manager

Enclosures

cc w/enclosures:
R. Kowalewski, DOE-HQ

cc w/o enclosures:
L. Mahier, Weston OTS
H. Perry, Geotech

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OU III AR 569a

Department of Energy
Grand Junction Projects Office
Post Office Box 2567
Grand Junction, Colorado 81502–2567

DEC 0 1 1992

Mr. Paul Mushovic, Regional Project Manager
Environmental Protection Agency
Region VIII, Suite 500
Mail Stop 8HWM-FF
999 18th Street Denver Place
Denver, Colorado 80202-2405

Mr. Brent Everett
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
1950 West N. Temple
Salt Lake City, Utah 84116

SUBJECT: Transmittal of Monticello Millsite Surface and Ground Water Analytical Data Summary

Dear Mr. Mushovic and Mr. Everett:

Enclosed for your use are four copies of the Monticello Millsite Surface and Ground Water Analytical Data summary. If you require any clarification on the data presented, please call me at (303) 248-6014.

R. Eldon Bray
Project Manager

cc: L. Mahier, Weston OTS
R. Kowalewski, DOE-HQ, EM-451
H. Perry, Geotech, w/o attachment
T. Plessinger, DOE-GJPO

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Bray/KS 30 Nov/92 Plessinger 11/30/92 Tucker 11/30/92

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OU III AR 569 a

Department of Energy
Grand Junction Projects Office
Post Office Box 2567
Grand Junction, Colorado 81502-2567

APR 01 1996

Mr. Paul Mushovic, Remedial Project Manager
Environmental Protection Agency, Region VIII
Suite 500 Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environment Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Suspending Air Monitoring Activities and Decreasing Scope of OU III Annual Water Quality Monitoring

Dear Mr. Mushovic and Mr. Bird:

Enclosed are proposals for suspending air monitoring until tailings removal commences in 1997 and decreasing the scope of OU III annual water quality monitoring.

The proposal for suspending air monitoring is based on the premise that (1) activities planned up to tailings removal are not substantially different than the activities that have occurred to date, and (2) the data that has been collected over the last several years has not indicated any significant changes in the measurements reported, exceedences of regulatory standards, or radiological doses to the public. Therefore, since the air monitoring data has not indicated significant change compared to the activities that have occurred and this situation is expected to continue, there is no value added to the project to continue air monitoring until tailings removal occurs.

The proposed modifications to the OU III annual monitoring program involve (1) reducing the frequency of groundwater level and stream discharge measure from monthly to quarterly, (2) eliminating organic compounds from the list of target analytes, and (3) revising the groundwater and surface water sampling networks for the spring 1996 sampling event. These modifications are consistent with the proposed changes discussed with you during the March 4-5 OU III meeting in Salt Lake City, Utah.

If you have any questions on the information provided, please call me at (970) 248-6077.

Sincerely,

Mary Ann Rondinella

Mary Ann Rondinella
Monticello Project Coordinator

cc:
J. Berwick, DOE-GJPO
W. Busby, Rust

mr\mar\oustair

Proposed Modification of the Operable Unit III
Annual Monitoring Program

The DOE proposes to revise the technical approach for the surface water and groundwater annual monitoring program for Operable Unit (OU) III of the Monticello Mill Tailings Site (MMTS) . The current program consists of the following main components:

1. Groundwater level monitoring in 94 wells **monthly**.
2. Groundwater sampling of 36 monitoring wells for inorganics and radionuclides **semiannually**. (Wells installed during winter 1995 are sampled for inorganics and radionuclides **quarterly** for one year.)
3. Groundwater sampling of 5 monitoring wells for organic compounds **annually**.
4. Surface water discharge monitoring at 14 sites **monthly**.
5. Surface water sampling at 18 sites for inorganic and radionuclides **semiannually**.

DOE proposes revisions to this program to eliminate the collection of data that are not required for the ecological and human health risk assessment tasks or for groundwater modeling and as a result, to save unnecessary costs. The changes would not affect DOE's ability to effectively monitor groundwater or surface water quality at and near the millsite. The changes do not apply to the monitoring wells that were installed during winter 1995. The revisions proposed are:

1. Perform groundwater level monitoring **quarterly**.
2. Sample 18 groundwater monitoring wells for inorganics and radionuclides during the scheduled April 1996 event.
3. Discontinue groundwater sampling for organic compounds. As previously discussed, if organic compound contamination is discovered during millsite remediation, the need to reinstate groundwater sampling for organic compounds will be reevaluated.
4. Perform surface water discharge monitoring at 14 sites **quarterly**.
5. Sample 4 surface water sites for inorganic and radionuclides during the scheduled April 1996 event.

Monitoring well and surface water sites proposed for sampling are shown on Plate 1. Three of the monitoring wells shown on Plate 1 (31SW91-50, 31SW91-52, and 31SW91-55) have not been sampled before. They are proposed for inclusion in the April 1996 event because additional groundwater chemistry data is needed in the area near the carbonate pile. At this time, it is proposed that the fall low flow/low water level sampling that is usually conducted during October would occur as described in the *Draft Final Remedial Investigation/Feasibility Study Work Plan*.

Technical justifications for revising the program are:

1. Sufficient groundwater level elevation and surface water discharge data have

been collected to date to complete the baseline risk assessment and the RI/FS. Additional data are only needed to monitor and document fluctuations and trends. Groundwater level elevation and surface water discharge are generally at maximums in April and minimums in October. Collection of these data on a quarterly basis with April and October included as two of the rounds would be sufficient to document trends.

2. Groundwater and surface water data generally show highest concentrations of contaminants under low flow/low water level conditions. Elimination of the spring sampling round would not affect the DOE's ability to conservatively estimate contaminant concentrations in the water or to document long-term changes in the water quality. Time concentrations plots for select groundwater monitoring well locations and select analytes are shown in Attachment 1. Time concentration plots for select surface water sites and select analytes are shown in Attachment 2. Each attachment is arranged first by analyte and then by location starting with the western most location and proceeding to the east. The plots demonstrate that high concentrations are typically measured during fall.

3. Other than an occasional low concentration detection of primarily laboratory contaminants, organic compounds are not detected in the groundwater or surface water at the millsite. Organic compound data were obtained during four rounds of sampling in a one-year period from all upgradient and millsite monitoring locations in 1992/1993 during "baseline characterization" and are summarized in the *Monticello Mill Tailings Site, Operable Unit III, Baseline Characterization Data Summary* (DOE 1994). EPA, the State of Utah, and DOE agreed in Fall 1993 to reduce organic sampling effort to 5 upper flow system monitoring wells sampled annually. Samples have been collected at the 1 upgradient, 3 on site, and 1 downgradient monitoring well location since that time. The analytical data for these samples are presented in Attachment 3. As shown, the only volatile organic, semivolatile organic, pesticide, PCB, or herbicide compound detected was the semivolatile organic compound, bis (2-ethylhexyl)phthalate, a common laboratory contaminant. These physical data coupled with the lack of historical information indicating usage of organic compounds at the millsite provide sufficient rationale for deleting organics as analytes. If any evidence of organic contamination is discovered during millsite remediation, the decision to exclude organics as analytes will be reevaluated.

PROPOSAL FOR SUSPENDING AIR MONITORING AT THE MONTICELLO SITES

SUMMARY

Air monitoring data have been collected at the Monticello Sites since 1983 for various constituents. The data was reviewed for the last five years, and over that time, there has not been any significant change in the measurements obtained and therefore, contaminant exposure to the public. Because remediation activities that will be conducted up to the time of tailings removal are not expected to differ significantly from the remediation activities that have been conducted to date, DOE does not believe that there is the need to continue to collect air monitoring data until tailings removal commences. The data that would be collected would only reiterate data that have been collected over the last five years.

Therefore, DOE is requesting that EPA and the State of Utah concur in DOE's proposal to discontinue air monitoring until tailings removal commences.

1994 AIR MONITORING DATA SUMMARY

The air monitoring data have been documented by the Department of Energy (DOE) in annual reports that have been provided to regulatory agencies and the public. This proposal summarizes data from the *Monticello Mill Tailings Site Environmental Report for Calendar Year 1994 (DOE 1995)*. This data can be compared with data provided in previous years reports to substantiate that there has not been any significant change in the measurements taken. Air monitoring data for 1995 has not yet been compiled, and therefore is not used in this proposal. Review of quarterly data in 1995, however, does not show that there has been any significant change in air quality from 1994 to 1995.

Atmospheric Radon

Atmospheric radon concentration is measured at 15 locations using radon detectors. Excluding a natural background concentration of 0.4 pCi/l, the EPA standard (40 CFR 192) of 0.50 pCi/l is exceeded at two locations along the northern millsite boundary and one location east of the millsite. Concentrations at the remaining off-site locations are well below the standard.

Background radon monitoring equipment has been established at the repository site. One set of detectors has been collected. Although the original plan was to collect four quarters of data, this will no longer be conducted. The one quarter of data along with background that has been

established in previous reports will be used for determination of background at the repository site.

Two Pylon AB-5 real-time monitoring stations were installed adjacent to the millsite in August 1992 to determine the effect of increased construction activity associated with installation of the access area on ambient radon concentrations. The monitoring indicated that radon concentrations were consistently below the EPA standard.

Air Particulates

Air particulates monitoring occurs at 12 locations, including a background location. Filters are analyzed for total uranium, radium-226, and thorium-230, and at five of the locations, for particulate matter 10 um or smaller (PM_{10}).

Concentrations of uranium, radium-226 and thorium-230 are well below DOE's derived concentration guidelines (DCGs). DCGs represent the concentration that would cause a member of the public to receive a dose of 100 millirems per year from inhalation of the contaminant.

Acceptable levels of PM_{10} are defined by the EPA under the National Ambient Air Quality Standards. These PM_{10} standards specify a maximum annual arithmetic mean of 50 micrograms per cubic meter and a 24-hour maximum concentration of 150 micrograms per cubic meter. All measurements have been well below the standards.

Direct Gamma Radiation Monitoring

A direct environmental radiation monitoring program was initiated in 1991 to assess the potential gama radiation dose to persons on and near the millsite. Currently, measurements are taken at 19 locations, including one background location, using thermoluminescent dosimeters. Background gamma radiation is estimated at 95 millirems per year. Annual averages of measurements collected off of the millsite; including background; range from 65 millirem per year to 114 millirem per year. On the millsite, measurements range from 112 millirem per year to 463 millirem per year.

Background gamma monitoring equipment has been established at the repository site. One set of detectors has been collected. Although the original plan was to collect four quarters of data, this will no longer be conducted. The one quarter of data along with background that has been established in previous reports will be used for determination of background at the repository site.

REMEDIATION ACTIVITIES CONDUCTED IN 1994 AND 1995

Remediation activities in 1994 and 1995 have consisted of remediation of vicinity and peripheral properties, construction of millsite facilities such as ditches, ponds, and roads, and maintenance of the Interim Repository. The number of properties remediated and the acreages disturbed vary from year to year, however, the air quality data does not significantly change.

Work projected for 1996 up to the start of tailings removal is not expected to significantly change air quality compared to previous years activities. Approximately 28 vicinity properties and all or parts of seven peripheral properties will be remediated and maintenance of the Interim Repository will continue. On the millsite, the Millsite Maintenance subcontractor may excavate some of the mill building foundations, however, this will not disturb the tailings piles and will be similar to peripheral property cleanups (with regard to the nature of the excavated contaminated materials) that have occurred in the past.

Repository construction is occurring, however, only uncontaminated soils are being disturbed. Fugitive dust is being controlled to the standards required by the State of Utah Division of Air Quality, therefore, adverse impacts to the environment are not expected.

PROPOSAL

DOE requests that the EPA and UDEQ concur in suspending air monitoring until excavation of the tailings piles starts. This request is based on the premise that (1) activities planned up to tailings removal are not substantially different than the activities that have occurred to date and (2) the data that has been collected over the last several years has not indicated any significant changes in the measurements reported, exceedences of regulatory standards, or radiological doses to the public. Therefore, since the air monitoring data has not indicated significant change compared to the activities that have occurred and this situation is expected to continue, there is no value added to the project to continue air monitoring until tailings removal occurs.

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4-5-5

OUIII AR 569 A

Department of Energy
Grand Junction Projects Office
Post Office Box 2567
Grand Junction, Colorado 81502-2567

May 13, 1996

Mr. Paul Mushovic, Remedial Project Manager
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Suite 500 Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environment Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Operable Unit III Human Health Risk Assessment - Exposure Scenarios for Upper-Middle, Middle, and Lower Montezuma Creek

Dear Mr. Mushovic and Mr. Bird:

A description of revised exposure scenarios, and associated exposure factors, for the Operable Unit (OU) III human health risk assessment are enclosed for your review. The revised scenarios and exposure factors were developed on the basis of our discussions with you during the March 19, 1996, OU III technical meeting in Denver, Colorado. During the meeting, it was agreed that some revisions to the proposed exposure factors listed in the Streamlined Risk Evaluation for Soil and Sediment were necessary. In addition to the items discussed at the meeting, we have included exposure factors for the ingestion of beef tissues from cattle grazing within OU III. Although exposure factors for the beef-ingestion pathway were not specifically discussed during the meeting, the beef ingestion exposure scenario will definitely be evaluated in the Baseline Risk Assessment.

After you have reviewed the enclosed package, DOE would like to schedule a teleconference or video conference with you and your technical representatives to discuss any questions you may have and, if necessary, to further refine the exposure factors. We would like to schedule this teleconference within the next four weeks.

DOE believes that the March 19 technical meeting provided an efficient mechanism for effective resolution of technical issues associated with the OU III project. DOE would like to continue this approach for the human health risk assessment as well as for the other technical components of the project.

If you have any questions regarding the enclosed exposure scenarios, please call me at (970) 248-6077.

Sincerely,

Mary Ann Rondinella

Mary Ann Rondinella
Monticello Project Coordinator

cc w/o enclosure:
W. Busby, Rust Geotech
W. Merrill, Rust Geotech

Upper-Middle, Middle, and Lower Montezuma Creek Canyon Hypothetical Future Use Exposure Scenarios

Developed in Accordance With OSWER Directive 9355.7-04 Reasonable Anticipated Land Use

Upper-Middle Canyon, Extended Backyard

1) The Montezuma Creek flood plain, due to geophysical instability and the aesthetic value of the continuation of the "golf course - civic area" at the Millsite, will be designated common lands and set aside as a "green-belt".

2) In the upper canyon, privately held ranch land is sold and subdivided into smaller lots suitable for residential development. Given the desirability of these lots adjacent to the planned golf course and civic area, coupled with the green-belt, these are sizable rural ranch estate lots typically more than 3 acres in size.

3) The "Upper-Middle Canyon" (U-MC) segment is the western portion of the Middle Canyon that includes the beaver ponds (a.k.a. the "wet lands segment"). Because it is close to potential future residences and is a pond-like setting, the U-MC may be an engaging setting for periodic visits by nearby residents - particularly adolescent children.

4) Owners construct residences on the stable ground distal from the flood plain leaving an expansive backyard leading to the green-belt.

5) The green-belt abuts the residential properties which may or may not have privacy fences. Generally, the residences have free access to the green-belt. However, there does exist a legal step-off point between the residential property and the common green-belt.

6) The green-belt and the U-MC wet lands area becomes, in effect, a distal extension of the residential backyard.

7) Residents do not have routine direct contact with flood plain sediments and soils; however, preadolescent and school-age children (typically 5 to 14) may visit the green-belt and the U-MC as an extended backyard. Due to safety issues associated with the flowing steam and distance from the home, very young children (e.g., under 5) do not frequent the green-belt unescorted. Older children (e.g., over 15) are unlikely to frequent the U-MC as much as preadolescent and adolescents because of outside the home interests that emerge in the mid-teen years (after school activities, sports, driving, etc.)

8) A conservative estimation is that up to 25% of a child's outdoor at home activity time could occur in the *affected portion* of the flood plain.

9) Outdoor activity time in the flood plain is affected by local weather conditions and other activities such as school commitments. Thus, warm weather weekends and summer time are the main periods of significant exposure.

10) Typical activities in the U-MC include walking and child play.

11) Exposure pathway(s) to quantitatively evaluate:

- Preadolescent and adolescent children (e.g., 5 to 14) who have periodic incidental ingestion of soil/sediments associated with outdoor activities during suitable months (e.g., April through October).
- Exposure from external penetrating radiation to preadolescent and adolescent children (e.g., 5 to 14) associated with outdoor activities during suitable months (e.g., April through October).

12) Exposure pathway(s) to qualitatively evaluate:

- Infrequent incidental ingestion of soil/sediments by adults.
- Infrequent incidental ingestion of soil/sediments by occasional casual visitors.

Middle Canyon, Portal

1) The middle canyon is the narrow isthmus approximately ½ to ¾ mile in length between the U-MC and the lower canyon that functions as a pass-through or "portal" between the two segments.

2) The middle canyon walls are steep and provide an effective barrier for entry. Access to the middle canyon is limited to the upper and lower canyon portals.

3) Residences do not abut the flood plain in the canyon.

4) Due to the high canyon walls and rugged physical features, the middle canyon is not an extended backyard. Entry into the middle canyon is not casual (as in the upper canyon and U-MC).

5) Activities occurring in the middle canyon include: nature observance, photography, and hiking.

6) Use of the middle canyon as a portal and associated activities is occasional rather than routine.

7) Outdoor activity time in the middle canyon flood plain is governed by local weather conditions and other activities such as school. Safety concerns for rapidly rising Montezuma Creek stream flow also affect the decisions to use the middle canyon access/egress route to and from the lower canyon. Warm weather weekends and summer time are the main periods available for significant exposure.

8) Given the proximity to the lower canyon, it's plausible that a limited number of beef cattle graze in the middle canyon flood plain during warmer weather months (e.g., July through October) as is the current practice.

9) Exposure pathways to quantitatively evaluate:

   - Preadolescent and adolescent children (e.g., 5 to 14) who incidentally ingest soil/sediments while passing through the middle canyon.
   - Exposure from external penetrating radiation to preadolescent and adolescent children (e.g., 5 to 14) while passing through the middle canyon.
   - Intermittent consumption of beef from cattle pastured in the lower canyon from July to October.

10) Exposure pathways to qualitatively evaluate:

   - Occasional incidental ingestion of sediment/soil and external penetrating radiation encountered by adults while in the middle canyon flood plain.

Lower Canyon, Recreational Visitor

1) The lower canyon is an extension of the upper canyon and the green-belt extends through the lower canyon to Vega Creek.

2) Residences do not abut the flood plain in the lower canyon.

3) Due to the high canyon walls and rugged physical features, the lower canyon is not an extended backyard. Entry into the lower canyon is not casual (as in the upper canyon and U-MC).

4) Activities occurring in the lower canyon include: occasional picnicking, nature observance, photography, and hiking.

5) Lower canyon activities are occasional rather than routine.

6) Outdoor activity time in the lower canyon flood plain is even more affected by local weather conditions and other activities such as school than the upper canyon. Concerns for rapidly rising Montezuma Creek stream flow also affect the disposition to visit the lower canyon. Warm weather weekends and summer time are the main periods available for significant exposure.

7) It's plausible that a limited number of beef cattle graze in the lower canyon flood plain during the warmer weather months (e.g., July through October) as currently practiced.

8) Exposure pathways to quantitatively evaluate:

   - Preadolescent and adolescent children (e.g., 5 to 14) who have occasional incidental ingestion of sediment and soil associated with outdoor play during suitable months (e.g., April through October).
   - Exposure from external penetrating radiation to preadolescent and adolescent children (e.g., 5 to 14) associated with outdoor lower canyon activities during suitable months (e.g., April through October).
   - Intermittent consumption of beef pastured in the lower canyon from July to October.

9) Exposure pathways to qualitatively evaluate:

   - Occasional incidental ingestion of sediment and soil and external penetrating radiation exposure encountered by adults while in the lower canyon flood plain.

Table 1 Upper-Middle Canyon (U-MC)

Hypothetical Future-Use Exposure Factors Based on Highest Exposure Subpopulation (School Age Child Aged 5 to 14)
Direct Contact With Flood Plain Soil/Sediment - "Wet Land Area" Extended Backyard Scenario

Exposure Variable		Upper-Middle Canyon		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
1. Daily soil/sediment ingestion rate[a].	mg/day	59[b]	114[c]	[b] Median (Thompson & Burnmaster, 1991) [c] Average child (6 years) & adult (24 years) for 30 years (EPA, 1991a)
2. Period per day in U-MC *affected soil/sediment*	hrs/day	0.5[d]	0.75[e]	[d] Derived from Silvers *et al.* (1994). Assumes 25% of a child's "outdoor at home" activity time is spent *in the affected flood plain.* Access into the Montezuma Creek flood plain near the Beaver Ponds is assumed to follow patterns similar to those identified by Silvers *et al.* including different seasonal availabilities on weekdays and weekends (e.g., school age children and children supervised by adults) in an extended backyard scenario. [e] Upper end is the central tendency plus 1 sigma from Silvers *et al.* See the Reference/Notes the derived profile based on Monticello weather and children activity patterns from Silvers *et al.*
3. Days per year in U-MC *affected soil/sediment*	days/year	90[f]	175[g]	[f] Access into the U-MC Montezuma Creek flood plain (e.g., Wet Lands Area) would be impacted by local seasonal weather (e.g., 5 months when the average temperature is below 40 degrees with substantial snow cover). See derived profile based on Monticello weather (Utah Climate Center, 1994) and children activity patterns from Silvers *et al.* (1994) [g] Upper end is central tendency estimate plus a professional judgement 1 sigma estimate.
4. Exposure duration adjacent to flood plain	years	30[h]	30[h]	[h] 90 percentile (EPA, 1989a). Highly conservative to assume 30 years exposure when combined with the adolescent child contact rates.
5. Body weight	kg	70[i]	70[i]	[i] Average adult body weight (EPA, 1989a)
6. Gamma shielding factor (S_f)	none	0.5[j]	0.2[k]	[j] Based on observation of terrain in U-MC Montezuma Creek flood plain, non infinite heterogenous source, local roughness, soil water content, & dense vegetative cover (From EPA, 1993 & DOE 1993). [k] Conservative default (EPA, 1991b)
7. Averaging time cancer	days	25,550	25,550	EPA 1989

Table 1 Upper-Middle Canyon (U-MC)

Hypothetical Future-Use Exposure Factors Based on Highest Exposure Subpopulation (School Age Child Aged 5 to 14)
Direct Contact With Flood Plain Soil/Sediment - "Wet Land Area" Extended Backyard Scenario

Exposure Variable		Upper-Middle Canyon		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
8. Averaging time noncancer	days	3,285	10,950	Based on years of exposure (9 and 30 years respectively)

[a] Intake rate modification (currently under discussion with EPA and UDEQ) by: (hours/day in flood plain)/(24 incidental ingestion exposure hours available per day) (e.g., 0.37/24). Ratio of (time in flood plain /exposure hours available) is analogous to the FI factor in EPA Guidance (EPA, 1989a; Exhibit 6-14)).

The Upper-Middle Canyon is the area around the beaver ponds (i.e., "wet land area") located in the westerly most portion of the Middle Canyon. In this exposure scenario, the U-MC flood plain is considered an extended backyard or "Green-Belt" setting adjacent to but not legally within a sizable (e.g. 3 to 5 or more acres) rural residential plot. Surveys indicate that affected sediments in the U-MC, surveys indicate they are localized around the pond periphery, in overflow washes and , in depositional low points. Thus, only a portion of the potential exposure unit area is considered affected. Typical activities include walking, jogging, and child play.

Table 2 Middle Canyon (MC)

Hypothetical Future-Use Exposure Factors Based on Highest Exposure Subpopulation (School Age Child Aged 5 to 14)
Direct Contact With Flood Plain Soil/Sediment - Passage Way Scenario

Exposure Variable		Middle Canyon		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
8. Averaging time noncancer	days	3,285	10,950	Based on years of exposure (9 and 30 years respectively)

*Intake rate modification (currently under discussion with EPA and UDEQ) by: (hours/day in floodplain)/(24 exposure hours available per day) (e.g., 0.25/24). Ratio of (time in flood plain/exposure hours available) is analogous to FI factor in EPA Guidance (EPA, 1989a; Exhibit (6-14)).

Approximately ½ to ¾ mile in length, the Middle Canyon flood plain below the wet land area is restricted (due to rugged side terrain) and functions as a pass through (i.e., a portal) between the U-MC and the lower canyon. Typical activities include: occasional hiking, nature observing, and photography while in transit between U-MC and the lower canyon. The lower canyon segment has alternative access and egress routes that are generally less rigorous (e.g., draws and gentler slopes into the lower canyon). Thus, the middle canyon portal is but one of several access points between U-MC and the lower canyon.

Table 2 Middle Canyon (MC)

Hypothetical Future-Use Exposure Factors Based on Highest Exposure Subpopulation (School Age Child Aged 5 to 14)
Direct Contact With Flood Plain Soil/Sediment - Passage Way Scenario

Exposure Variable		Middle Canyon		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
1. Daily soil/sediment ingestion rate[a].	mg/day	59[b]	114[c]	[b] Median (Thompson & Burmaster, 1991) [c] Average child (6 years) & adult (24 years) for 30 years (EPA, 1991a)
2. Period per day in MC affected soil/sediment	hrs/day	0.25[d]	0.50[e]	[d] Professional judgement of typical "pass-through time" based on observation and actual walk-through of the ~½ to ¾ mile segment east of the "wet land" portion. (3 mph). [e] Upper end estimate is conservatively estimated as twice the central tendency (i.e., rate ~1.5 mph).
3. Days per year in MC affected soil/sediment	days/year	14[f]	21[g]	[f,g] Professional judgement based on experience and familiarity with terrain and alternative access routes to the lower canyon. Linked to the lower canyon visitation rate - it assumes two passages (trips per day [in and out]). One-half of the visits to the lower canyon (See Table 3) occur through the middle canyon portal.
4. Exposure duration adjacent to MC soil/sediment	years	30[h]	30[h]	[h] 90 percentile (EPA, 1989a). Highly conservative to assume 30 years exposure when combined with the adolescent child contact rates.
5. Body weight	kg	70[i]	70[i]	[i] Average adult body weight (EPA, 1989a)
6. Gamma Shielding factor (S_f)	none	0.5[j]	0.2[k]	[j] Based on observation of terrain in Montezuma Creek flood plain, non infinite heterogenous source, local roughness, & dense vegetative cover (From EPA, 1993 & DOE 1993). [k] Conservative default (EPA, 1991b)
7. Averaging time cancer	days	25,550	25,550	EPA (1989a)

Table 3 Lower- Canyon (LC)

Hypothetical Future-Use Exposure Factors Based on Highest Exposure Subpopulation (School Age Child Aged 5 to 14)
Direct Contact With Flood Plain Soil/Sediment - "Wet Land Area" Visitation Scenario

Exposure Variable		Lower Canyon		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
1. Daily soil/sediment ingestion rate[a]	mg/day	59[b]	114[c]	[b] Median (Thompson & Burmaster, 1991) [c] Average child (6 years) & adult (24 years) for 30 years (EPA, 1991a)
2. Period per day in LC affected soil/sediment	hrs/day	0.7[d]	1.0[e]	[d] Derived from Silvers *et al.* (1994). Conservatively assumes 25% of a child's "outdoor away from home" activity time is spent in the affected lower canyon soil/sediments. Access into the lower canyon is likely to follow patterns similar to those identified by Silvers *et al.* which includes different availabilities on weekday and weekends (e.g., school age children and children supervised by adults). Upper end estimate is the central tendency plus 1 sigma (from Silvers *et al.*). [e] See the Reference/Notes for the derived profile based on Monticello weather and children activity patterns.
3. Days per year in LC affected soil/sediment	days/year	14[f]	21[g]	[f,g] Professional judgement based on experience and familiarity with terrain, regional activity patterns, and discussion with local residents.
4. Exposure duration adjacent to LC flood plain	years	30[h]	30[h]	[h] 90 percentile (EPA, 1989a). Highly conservative to assume 30 years exposure when combined with the adolescent child contact rates.
5. Body weight	kg	70[i]	70[i]	[i] Average adult body weight (EPA, 1989a).
6. Gamma shielding factor (S_γ)	none	0.5[j]	0.2[k]	[j] Based on observation of terrain in Montezuma Creek flood plain, non infinite heterogenous source, local roughness, & dense vegetative cover (From EPA, 1993 & DOE 1993). [k] Conservative default (EPA, 1991b).
7. Averaging time cancer	days	25,550	25,550	EPA (1989a)

Table 3 Lower- Canyon (LC)

Hypothetical Future-Use Exposure Factors Based on Highest Exposure Subpopulation (School Age Child Aged 5 to 14)
Direct Contact With Flood Plain Soil/Sediment - "Wet Land Area" Visitation Scenario

Exposure Variable		Lower Canyon		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
8. Averaging time noncancer	days	3,285	10,950	Based on years of exposure (9 and 30 years respectively).

[a] Intake rate modification (currently under discussion with EPA and UDEQ) by: (hours/day in floodplain)/(24 exposure hours available per day) (e.g., 0.68/24). Ratio of (time in flood plain/exposure hours available) is analogous to FI factor in EPA Guidance (EPA, 1989a; Exhibit 6-14)).

Lower Canyon flood plain is considered a semi restricted (due to rugged terrain and distance from the residences) recreational visitor setting in the vicinity of a rural residential neighborhood. While affected sediments may occur anywhere in this segment, field surveys indicate that they are localized in depositional low spots. Typical activities include: occasional picnicking, hiking, nature observing, and photography.

Table 4 Ingestion of Cattle Tissues

Exposure Factors Associated With The Ingestion of Beef Tissues From Cattle Grazing in Middle and Lower Montezuma Creek During July to October

Exposure Variable		Middle-Lower Creek		Remark/Reference See References for Elaboration
		Central Tendency	Upper End	
1. Daily Cattle Tissue Ingestion Rate[a] - muscle - liver Total Daily Beef Uptake	mg/day	 42.5[a] 1.5[a] 44[b]	 72.45[a] 2.55[a] 75[c]	[a,b] This is the average consumption rate for beef listed in EPA (1989b). This is an allocation of total beef consumption based on Lapham *et al.* (1989). Only data for muscle and liver were used because this scenario assumes a local user slaughters his own cattle, consumption of kidney was not assumed because it is found only in processed meats (hot dogs, bologna). [c] From EPA (1989b) and EPA (1991a) for reasonable worst case consumption of beef for all tissue types.
2. Exposure Frequency - muscle - liver	day/year	 200[d] 200[d]	 350[e] 350[e]	[d] This assumes consumption of beef 4 out of 7 days per week. [e] From EPA (1991a) for an agricultural scenario.
3. Exposure Duration	years	30[f]	30[f]	[f] Listed in EPA (1991a) for the agricultural scenario.
4. Body weight	kg	70[g]	70[g]	[g] Average adult body weight (EPA, 1989a).
5. Gamma shielding factor (S_f)	none	0.5[h]	0.2[i]	[h] Based on observation of terrain in Montezuma Creek flood plain, non infinite heterogenous source, local roughness, & dense vegetative cover (From EPA, 1993 & DOE 1993). [i] Conservative default (EPA, 1991b).
6. Averaging time cancer	days	25,550	25,550	EPA (1989a)
7. Averaging time noncancer	days	3,285	10,950	Based on years of exposure (9 and 30 years respectively).

[a] Intake rate modification (currently under discussion with EPA and UDEQ) by: (hours/day in floodplain)/(24 exposure hours available per day) (e.g., 0.68/24). Ratio of (time in flood plain/exposure hours available) is analogous to FI factor in EPA Guidance (EPA, 1989a; Exhibit 6-14)).

Lower Canyon flood plain is considered a semi restricted (due to rugged terrain and distance from the residences) recreational visitor setting in the vicinity of a rural residential neighborhood. While affected sediments may occur anywhere in this segment, field surveys indicate that they are localized in depositional low spots. Typical activities include: occasional picnicking, hiking, nature observing, and photography.

Upper - Middle, Middle (Portal), and Lower Canyon Exposure Equations

$CDI_{\text{chemical mg/kg-day}}$ = mg/kg * mg/day * (hrs/day in flood plain / 24 exposure hours/day) * days/year in flood plain * years / (10^6 mg/kg * kg_w * $days_{AT}$)

$CDI_{\text{Radionuclides pCi/He}}$ = [(pCi/gr*mg/day * (hrs/day in flood plain / 24 exposure hours/day) * (days/year in flood plain) * years / 10^3 mg/gr) + (pCi/gr* (1-S_i) * (hrs/day in flood plain / 24 exposure hours/day) * day/year in flood plain years))]

References and Notes

Silvers, A., Florence, B.T., Rourke, D.L., and R.J. Lorimor, 1994, How Children Spend Their Time: A Sample for Use in Exposure and Risk Assessments, *Risk Analysis*, Vol. 14, No. 6.

Article presents findings of a survey to determine behavior patterns of children on both weekends and weekdays over all four seasons. This work was coupled with historical Monticello weather data to develop a Child Age 5 -14 Time in Flood Plain Profile (See Figures 1 and 2). Access into the Montezuma Creek flood plain would follow a pattern consistent with those identified by Silvers et al. which includes different availabilities on weekday and weekends (e.g., school age children and children supervised by adults) as well as the local seasonal weather (e.g., 5 months when the average temperature is below 40 degrees, substantial snow cover, Montezuma Creek frozen, etc.).

Thompson, K.M., and D.E. Burmaster, 1991, Parametric Distributions for Soil Ingestion by Children, *Risk Analysis*, Vol. 11, No.2.

Article presents parameterized distributions of estimates of soil ingestion rates based on the original data collected by Binder *et al.* (1986). An accuracy modification to the original data, following discussions by the authors with Binder, was made. The Binder et al. Study is the basis for EPA guidance. This work represents an update of the work used by EPA in their 1989 Risk Assessment Guidance for Superfund (EPA 1989a) as well as the more recent 1991 Supplemental Guidance (EPA 1991a) on default exposure factors. Published after release of EPA Guidance, Thompson and Burmaster's work probably reflects the best available regulatory science.

Utah Climate Center, 1994, Monticello Monthly Data Summary, Utah State University, Provo, UT

EPA guidance recommends developing of site-specific exposure data. This up-to-date information supports an interpretation of likely human behavior patterns with respect to access to the flood plain.

U.S. Department of Energy, 1993. Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0, ANL/EAD/LD-2, Environmental Assessment Division, Argonne National Laboratory.

U.S. Environmental Protection Agency, 1989a. Risk Assessment Guidance for Superfund, Office of Emergency and Remedial Response, EPA/540/1-89/002, Washington, D.C.

_____, 1989b. Exposure Factors Handbook, Office of Health and Environmental Assessment. EPA/600/8-89/043, Washington, D.C.

_____, 1991a. Human Health Evaluation manual Supplemental Guidance: "Standard Default Exposure Factors", Office of Solid Waste and Emergency Response Directive 9285.6-03, Washington, D.C.

_____, 1991b. Human Health Evaluation manual, Part B: "Development of Risk-based Preliminary Remediation Goals", Office of Solid Waste and Emergency Response Directive 9285.7-01B, Washington, D.C.

_____, 1993. External Exposure to Radionuclides in Air, Water, and Soil, Federal Guidance Report No. 12, EPA 402-R-93-08, Office of Radiation and Indoor Air, Washington, D.C.

_____, 1995. Land Use in the CERCLA Remedy Selection Process, Office of Solid Waste and Emergency Response Directive 9355.7-04, Washington, D.C.

Note: Flood plain and green-belt are synonymous

4-5-60

OU III AR 569 a

Department of Energy
Grand Junction Projects Office
Post Office Box 2567
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JAN 07 1997

Mr. Paul Mushovic, Remedial Project Manager
Environmental Protection Agency, Region VIII
Suite 500 Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

SUBJECT: Draft Minutes from the Monticello Operable Unit III Meetings

Dear Mr. Mushovic and Mr. Bird:

Enclosed for your review is a draft summary of the minutes from the Monticello Operable Unit III technical meetings held in Salt Lake City on December 11-12, 1996. Please distribute the extra copies to your staff as appropriate.

Please forward any questions or comments on the minutes to my attention, or feel free to call me at (970) 248-6077.

Sincerely,

Mary Ann Rondinella

Mary Ann Rondinella
Monticello Project Coordinator

Enclosures:
EPA (3)
UDEQ (2)

cc w/o enclosures:
M. Butherus, MACTEC-ERS

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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: 96.05-03
CONTROL NO.: 3100-T97-0013

January 6, 1997

Monticello Project Coordinator
Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503
ATTN: Mary Ann Rondinella

SUBJECT: Contract No. DE-AC13-96GJ87335—Operable Unit III Draft Meeting Minutes

Dear Ms. Rondinella:

Enclosed for your review is a summary draft of the minutes from the Monticello Operable Unit III technical meetings held in Salt Lake City on December 11-12, 1996. Upon your approval, three copies for the Environmental Protection Agency and two copies for the Utah Department of Quality will be transmitted.

Should you have any questions, please call me at Extension 6332.

Sincerely,

Michael C. Butherus
Manager, Monticello Program

KLM/djg
Enclosure
cc w/: K. L. McClellen
Project File MSG 1.11

cc w/o: Contract File (C. Spor)

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Operable Unit III Meeting Minutes
December 11-12, 1996
Salt Lake City, Utah

DRAFT

Following is a summary for the Monticello Mill Tailings Site (MMTS), Operable Unit III technical meetings held on December 11-12, 1996 in Salt Lake City, Utah. The following people participated in the meetings:

Name	Organization	Attendance Date	Phone
Many Ann Rondinella	U. S. DOE	Dec. 11,12, 1996	970-248-6077
Kristen McClellen	MACTEC	Dec. 11,12, 1996	970-248-6554
Jody Waugh	MACTEC	Dec. 11, 1996	970-248-6431
John Wegrzyn	Harding Lawson	Dec. 11, 1996	303-293-6173
Ronette Reisenburg	U. S. FWS	Dec. 11, 1996	801-524-5009x139
Paul Mushovic	U. S. EPA	Dec.11, 12, 1996	303-312-6662
Gerry Henningsen	U. S. EPA	Dec.11, 1996	303-312-6673
Dale Hoff	U. S. EPA	Dec.11, 1996	303-312-6690
Richard Graham	U. S. EPA	Dec.11, 12, 1996	303-312-7080
Mario Robles	U. S. EPA	Dec.11, 12, 1996	303-312-6160
Rich Muza	U. S. EPA	Dec. 11 (afternoon), 12, 1996	303-312-6595
Brent Everett	UDEQ	Dec. 11, 1996 (morning)	801-536-4171
David Bird	UDEQ	Dec. 11, 12, 1996	801-536-4219
Scott Everett	UDEQ	Dec. 11, 1996	801-536-4117
Loren Morton	UDEQ	Dec. 11(afternoon), 12, 1996	801-536-4250
Roberta Bowen	MACTEC	Dec. 12, 1996	970-248-7695
Tim Bartlett	MACTEC	Dec. 12, 1996	970-248-7741
Bruce Smith	MACTEC	Dec. 12, 1996	970-242-4749

The purpose of the meeting on December 11th was to discuss and resolve issues associated with the Operable Unit III ecological risk assessment and to discuss the preliminary results of the human health risk assessment; on December 12th, the groundwater modeling effort was statused.

December 11, 1996

Results of September 1996 Soil and Sediment Sampling

MACTEC displayed maps exhibiting radium-226 data in the 0-6-inch depth interval in upper, middle, and lower Montezuma Creek. The depth at which radium-226 contamination exists was discussed in each section of the OU III study area. Soil and sediment analytical results for all data that will be included in the remedial investigation report (RI) were distributed. Results show that below the "rugged canyon area" near the confluence with Verdure, all analytes exhibit concentrations at or below background concentrations except for lead-210 and uranium. Upper confidence level concentrations based on a lognormal distribution for lead-210 and uranium were 3.39 pCi/g and 5.12 pCi/g, respectively, near the Verdure confluence, compared to 1.86 pCi/g and 3.99 pCi/g, respectively, in the reference area. MACTEC stated that these results indicate that MMTS contamination does not appear to extend below the rugged canyon area.

Ecological Risk Assessment Discussion Topics

The chemicals of concern toxicity benchmark values (TBVs) provided in November were discussed (Attachment 1). EPA commented that they were familiar with some of the references and requested copies of all literature for TBVs that were selected. Comments were made that some of the intertaxon uncertainty factors appeared to be too large and that it was difficult to review the tables without a narrative on the criteria that were used for developing the TBVs. EPA stated that they accept Suter's (ORNL) TBVs for screening assessments only. It was commented that both NOAELs and LOAELS should be used to calculate a range of hazard indices. **MACTEC took action items to supply a narrative on the TBV selection approach and interconnection of tables (Attachment 1) and copies of cited literature (Attachment 2).**

The exposure parameters provided in November were discussed (Attachment 3). Comments primarily focused on whether aquatic invertebrates should be included in the muskrat diet. It was decided that unless a reference was supplied listing the percent of a muskrat diet that was composed of invertebrates, that calculations would be made using the diet fraction specified which is consistent with *Wildlife Exposure Factors Handbook* (EPA 1993). A comment was also made that both reasonable maximum exposure and central tendency exposure parameters should be used to estimate a range of potential risks, and the impacts of the exposure parameters should be incorporated into the uncertainty analysis. The ecological risk assessment report will include text on rationale for receptor and exposure parameter selection.

Surface water and biota analytical results were distributed for all data to be included in the RI. The exposure point concentrations (EPC) term will be the 95% UCL or the maximum detectable value, as appropriate, and only co-located transect data will be used. For mule deer, hazard indices will be calculated for all Montezuma Creek transects combined and for upper Montezuma Creek transects only. For deer mouse, hazard indices will be calculated for the upper Montezuma Creek transects, middle Montezuma Creek transects, and lower Montezuma Creek transects only. [Note: a subsequent review of the data shows that there is no non-flying invertebrate data for lower Montezuma Creek and therefore, hazard indices for this region are not possible.] For the spotted bat and the southwest willow flycatcher, hazard indices will be calculated using the 1995 combined flying and non-flying invertebrates and co-located soil data, and using the 1996 flying invertebrate data and co-located soil data from upper Montezuma Creek transects 21, 22, and 23 and middle Montezuma Creek transects 24 and 25. For the peregrine falcon and muskrat, hazard indices will be calculated for upper Montezuma Creek transects only.

With regards to muskrat sampling, no decision was made as to whether muskrat collection was necessary. **MACTEC took an action item to rerun the exposure calculations using the Verdure Creek reference area data (Attachment 4).**

Elimination of sulfate as a contaminant of concern was discussed and concurrence was attained. The justification for elimination of sulfate as a COC will be included in the risk assessment.

Elimination of suspect data points was discussed. The risk assessors and project managers are open to deleting these data points from exposure calculations if comparisons to abiotic media show

no similarity in increased concentrations, concentration ratios with other analytes are inconsistent, and the value is a clear outlier. The risk assessment will include text justifying the deletion of any sample result.

Concerning radiological dose calculations, it was suggested that a screening-level assessment for receptors with the highest probability of exposure (e.g., muskrat and deer mouse) would be sufficient to establish that radiological risk is not a significant terrestrial and aquatic risk driver. EPA agreed to work with DOE on an acceptable approach.

Human Health Risk Assessment Discussion

MACTEC statused the preliminary RME for upper, middle, and lower Montezuma Creek for current and future use (Attachment 5). EPA suggested that a vegetable garden scenario should be evaluated in the human health risk assessment. This scenario assumes that the garden is located adjacent to a future residence in the area outside of the OU III study area in an area that has already been remediated to the standards specified in the existing ROD. This scenario also assumes that the garden is irrigated with contaminated groundwater from the alluvial aquifer.

The regulators recommended that the risks associated with background concentrations of the COCs, the incremental risks (i.e., risks from OU III minus risks from background alone), and a dose assessment (in mrem/year) be included in the baseline risk assessment for human health.

There was discussion that under the current scenario some exposure pathways were either not complete or exposure was less than expected under the future scenario. There was agreement that in these cases (e.g., recreational and agricultural exposure factors) the future scenario could be used as surrogates for the current scenario.

For contaminants such as sodium and sulfate where minimal toxicological data are available, it was agreed that it would be appropriate to discuss them qualitatively in the uncertainty section. Similarly, there are no RfDs available for arsenic and uranium and therefore, it is appropriate to discuss them qualitatively in the uncertainty section.

EPA and the State of Utah agreed with the suggested approach of a fairly streamlined risk assessment and the ample use of detailed appendices. EPA stressed that DOE's references to the appendices must be easy to follow.

All parties agreed on the two suggested locations for the potential future residences (Well locations P92-09 and P92-05).

There was considerable discussion on what time frame was appropriate to assume that a potential future resident begins to consume contaminated alluvial aquifer water. It was suggested that the groundwater modeling output for 10 years and 30 years might be reasonable time frames to use for input into the risk assessment. The State thought that those years were probably okay for the central tendency scenario, but that current concentrations should be input for the RME scenario to be more conservative. **EPA and/or the State will provide further input to DOE on this issue.**

The day opened with discussion on the Mancos and Dakota water chemistry. DOE has made no conclusions as to whether or not the Mancos and Dakota are contaminated; however, the data do not strongly indicate that these units are contaminated. The data collected to date are difficult to interpret because 1) the samples numbers are limited, 2) in most cases the wells yield little water and so are difficult to develop and yield samples high in total dissolved and total suspended solids, and 3) water quality is variable even in upgradient wells. DOE will continue to monitor the newly constructed monitoring wells (the 1995 series wells) and will consider monitoring additional Mancos and Dakota wells as it develops a revised surface water and groundwater monitoring plan this winter. **MACTEC took an action item to prepare trilinear diagrams for the Mancos and Dakota wells (Attachment 6).**

The State questioned what method was being used for gross alpha and gross beta analyses and stated that in samples with high total dissolved solids EPA 900 series was not appropriate. **MACTEC took an action to review the analytical methods being used and to incorporate any revisions if necessary in the revised surface water and groundwater monitoring plan.**

Groundwater flow calibration was updated (handouts distributed are included as Attachment 7) and the recharge of city water in the northwest part of the millsite discussed. Comment was made to consider possible recharge in the southwest part of the millsite in the area where French Drains have been installed. Preliminary MODFLOWP results were distributed (Attachment 8) and the zones sensitive to conductivity and recharge were pointed out. No significant comments were made on these topics.

Discussion continued with the status of transport calibration. It was mentioned that the distribution of contaminants was used to help further refine the flow model. Source loading during tailings pile emplacement was described along with the work that was done to characterize the residual contamination in the vadose zone (RVZ). It was explained that a worst case scenario is being used with respect to RVZ contamination in the attenuation runs and that all runs assume that the other significant source of contamination is water that is already contaminated. Preliminary results for uranium and arsenic attenuation were reported at a few locations. **MACTEC took an action item to prepare time-predicted concentration plots at a couple of locations for a couple of analytes (Attachment 9).**

The meeting concluded with DOE stating that the human health risk calculations indicate that active treatment of the groundwater will probably be necessary, and that it is pursuing funding for this activity.

Attachments:
As stated

4-5-7

OU III AR 569a

U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
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OCT 08 1997

Mr. Paul Mushovic, Remedial Project Manager
Environmental Protection Agency, Region VIII
Suite 500 Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

SUBJECT: Transmittal of Monticello Mill Tailings Site Operable Unit III *Annual Monitoring Program*

Dear Mr. Mushovic and Mr. Bird:

Enclosed are two copies of the subject document for your information. Also enclosed are DOE's responses/resolutions to your comments on the Annual Monitoring Program.

If you have any questions or concerns, please contact me at (970) 248-7612.

Sincerely,

Donald R. Metzler
Project Manager

Enclosures

cc w/o enclosures:
M. Butherus, MACTEC-ERS
MSG 1.3.5

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MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: MAC98-03
CONTROL NO.: 3100-T98-0002

October 1, 1997

Project Manager
Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503
ATTN: Donald R. Metzler

SUBJECT: Contract No. DE-AC13-96GJ87335—Annual Monitoring Program for Operable Unit III

Dear Mr. Metzler:

Enclosed are six copies of the Monticello Mill Tailings Site, Operable Unit III, Annual Monitoring Program that were prepared per the Monticello Surface and Groundwater Task Order. Two copies each are for EPA and the State of Utah. Comments from EPA and the State of Utah and suggested DOE comment responses are also enclosed.

Should you have any questions, please call me at Extension 6332.

Sincerely,

Michael C. Butherus
Manager, Major Projects

KLM/djg
Enclosure
cc w/: Project File: MSG ~~2.2~~ 1.3.5

cc w/o: K. L. McClellen
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EPA Comment/Resolution: Annual Monitoring Program

General Comment

1. EPA and UDEQ would like to discuss with DOE and develop a format for submitting the analytical data which is more user friendly. The existing presentation is confusing and difficult to follow. We believe that a new format should be developed in the Annual Monitoring Program document.

Response:

DOE welcomes the opportunity to work with EPA and UDEQ to make the analytical data tables more user friendly. However, DOE's preference is to develop the format outside of Annual Monitoring Program document. The reason for this is that the format of data output is somewhat dynamic depending on the data users needs.

2. DOE needs to include a discussion of the method proposed by the UDEQ to analyze for radionuclides in turbid water.

Response:

Additional information has been added on an alternative analytical procedure (coprecipitation) for measuring gross alpha and gross beta in turbid or high TDS water.

Specific Comments

3. **Page 2–1, Section 2.0, Water Sampling Locations and Frequency:** Section 1.0 gives a good general description of reasons for reducing the number of wells in the monitoring program. DOE needs to give a more detailed explanation in Section 2.0 of the reasons for deleting specific wells from the monitoring program. Details should be on a well by well (or group, if applicable) basis. Some wells have only been deleted from the April ('98 and later) sampling round, and the reasons for this should also be given.

Response:

Additional text has been added to the document to describe the rationale behind deletion of wells from the monitoring network.

4. **Figure 2.1, page 2-5:** Please note that the Dakota Sandstone ground water monitoring well immediately west of Highway 191 is incorrectly labeled on this figure. Please correct and make certain all other figures are consistent.

Response:

The figure has been revised and all other figures checked.

EPA Comment/Resolution: Annual Monitoring Program (continued)

5. Page 3-5, Table 3.4-1 Water Sampling Equipment: The decontamination procedures in Section A-19 include alcohol and nitric or hydrochloric acid. Please explain why they are not included in this table.

Response:

Section 3.9, Equipment Decontamination Procedures, specifies Method B of the Standard Practice for Equipment Decontamination. Method B involves decontamination with control water and detergent; equipment blank results over the last 6 years indicate that this method of decontamination is sufficient for the contaminants of concern at the millsite. Because alcohol and acids are not required by the procedure specified, they are not included in the table.

U.S. Department of Energy
Grand Junction Office
2597 B 3/4 Road
Grand Junction, CO 81503

APR 11 1997

Mr. Paul Mushovic, Remedial Project Manager
Environmental Protection Agency, Region VIII
Suite 500, Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Transmittal of Monticello Mill Tailings Site Operable Unit III *Draft Annual Monitoring Program*

Dear Mr. Mushovic and Mr. Bird:

Enclosed are two copies of the subject draft document for your review.

If you have any questions or concerns, please contact me at (970) 248-6077.

Sincerely,

Mary Ann Rondinella

Mary Ann Rondinella
Monticello Project Coordinator

Enclosure(s)

cc w/o enclosures:
J. Berwick, DOE-GJO
M. Butherus, MACTEC-ERS

m:\mar\monitor.epa

MSG 1.3.5

MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: 96-05.03
CONTROL NO.: 3100-T97-0519

April 4, 1997

Monticello Project Coordinator
Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503
ATTN: Mary Ann Rondinella

SUBJECT: Contract No. DE-AC13-96GJ87335—Transmittal of Operable Unit III *Draft Annual Monitoring Program*

Dear Ms. Rondinella:

Enclosed are two copies of the subject draft document for your review, and four copies for transmittal to the Environmental Protection Agency and State of Utah.

Should you have any questions, please call me at Extension 6332.

Sincerely,

Michael C. Butherus
Manager, Monticello Program

KLM/djg
Enclosure
cc w/o: J. D. Berwick, DOE-GJO
K. L. McClellen
Contract File (C. Spor)
Project File: MSG ~~2.8~~

MSG 1.3.5

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2597 B 3/4 ROAD
GRAND JUNCTION, COLORADO 81503
970/248-6000 (FAX) 970/248-6040

MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: 96-5.3
CONTROL NO.: 3100-T97-0307

February 28, 1997

Monticello Project Coordinator
Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503
ATTN: Mary Ann Rondinella

SUBJECT: Contract No. DE-AC13-96GJ87335—Annual Monitoring Program for Operable Unit III

Dear Ms. Rondinella:

Enclosed are two copies of the *Draft Monticello Mill Tailings Site, Operable Unit III, Annual Monitoring Program* that were prepared per the Monticello Surface and Groundwater Task Order deliverables. This annual monitoring program proposes to omit the April 1997 sampling round because current surface water and groundwater conditions are well characterized, and because the data collected during this event will not reflect any changes due to remediation at the millsite and will not be incorporated into the Remedial Investigation Report. Because this is a proposed change from the current monitoring program, EPA and the State of Utah will need to be notified of the proposed changes prior to April when sampling was scheduled to occur.

A Document Release Form has not been submitted because the document is still in draft form.

Should you have any questions, please call me at Extension 6332.

Sincerely,

Michael C. Butherus
Manager, Monticello Program

MCB/djg
Enclosure (2)
cc w/o: K. L. McClellen
Contract File (C. Spor)
Project File: MSG

MSG 1.3.5

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2597 B 3/4 ROAD
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970/248-6000 (FAX) 970/248-6040

4-5-8

OU111 AR 569a

U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503

MAY 11 1998

Mr. Paul Mushovic
Environmental Protection Agency, Region VIII
Suite 500, Mail Stop 8HWM–FF
999 18th Street, Denver Place
Denver, CO 80202–2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Permeable Reactive Treatment Wall at Monticello

Dear Mr. Mushovic and Mr. Bird:

At the recent Federal Facilities Agreement meeting, you requested that the U.S Department of Energy provide additional information on the Permeable Reactive Treatment (PeRT) Wall Project at Monticello to help you determine if regulatory input is needed at this time. This memorandum summarizes the following:

1. Project status and schedule (Enclosure 1)
2. Results of the laboratory treatability studies (Enclosure 2)
3. Characterization Plan for Monticello PeRT Wall Project (Enclosure 3)
4. Field Column Tests for the TDI Project–Data Quality Objectives (Enclosure 4)
5. Potential Reduction in Risks to Human Health from use of the PeRT Wall (Enclosure 5)
6. PeRT Flow Modeling Approach and Summary-to-Date (Enclosure 6)

The preliminary results for the flow modeling will be forwarded to you by May 21. These submittals will provide sufficient information for a productive meeting to be scheduled in early June, following your review of the data and issues.

Project Status

We are ahead of schedule and have pushed the tracer design study forward to appropriately begin in July, following finalization of the PeRT Wall Design.

Laboratory Treatability Results

The laboratory treatability tests have been completed using numerous types of materials. The most promising materials are different types and sizes of zero valent iron (ZVI). A potential problem with ZVI, however, is the release of iron in solution. This is going to be evaluated further in the field treatability tests by examining the effect of iron concentrations as it passes through a column of native soil.

A summary of results of the laboratory treatability tests is enclosed. The results are based on a typical pore volume of 500. This summary shows that several materials have been very effective in removing the major contaminants of concern to levels below the maximum contaminant level (MCL) and/or risk-based levels.

Field Column Tests for the TDI Project

Progress is being made in the arrangements for the field treatability studies; these are expected to begin in mid-May. The current plan is to set up field columns in a trailer located just below Pond 3 using ground water from Well 88–85. The most promising materials identified in the laboratory treatability tests will be evaluated in the field columns. The Data Quality Objectives for these tests are enclosed.

Characterization Plan for Monticello PeRT Wall Project

As part of the design efforts, preliminary evaluation of PeRT Wall configurations (e.g., funnel and gate) and various emplacement methods (e.g., sheet piling, slurry wall, continuous trencher) are being conducted, and specific mobilization costs, construction costs per square foot, and construction durations are being compiled. These evaluations will input into finalization of the PeRT Wall Design to be included in the Request for Proposal. The Characterization Plan enclosed will determine field conditions (depth to bedrock, potential for boulders, etc.) which may limit the full suite of available emplacement technologies considered.

Potential Reduction in Risks to Human Health from Use of the PeRT Wall

The potential reduction in future risk was evaluated using effluent concentrations from the laboratory treatability tests. Future potential risks were estimated based on the assumptions and exposure parameters used in the Operable Unit III Baseline Risk Assessment. This analysis showed a significant decrease in future potential risks to acceptable levels. The final analysis is enclosed for your review.

PeRT Flow Modeling Approach and Summary-to-Date

Performance modeling is continuing using the Operable Unit III ground water. Modeling will assume irrigation of an up-gradient golf course to account for the highest anticipated transient ground water level. The model will be used to evaluate various wall and gate configurations for: (1) potential backup or mounding of ground water behind the reactive gate, (2) the flow patterns through a reactive gate, and (3) the percentage of contaminated ground water that can be treated with various configurations and wall lengths. Based on the modeling, DOE will recommend the gate cross-sectional area and wall configuration to maximize contaminant reduction and reactive life of the gate while minimizing any ground water mounding impacts to continuation of current agricultural land use. The modeling parameters and assumptions to be used are summarized on the enclosure.

Project Team Meeting

As part of the project team, DOE would like to get input from EPA and the Utah Department of Environmental Quality on several issues at a meeting convened either in person or phone before June 15. These issues include:

- Discussion of dissolved iron concentrations, plans to deal with this issue in the field treatability testing, and results from other PeRT Wall locations.
- Input on the tracer study, including potential tracer materials.
- Preliminary results of the modeling efforts such as the potential for water backup (mounding) and the expected percentage of the aquifer flow that will pass through the wall.
- Preliminary calculations of anticipated contaminant concentrations in the reactive media several decades in the future, and the criteria and thresholds for determination of stabilize-in-place versus exhume decisions.

If you have any questions, please contact me at (970) 248-7735.

Sincerely,

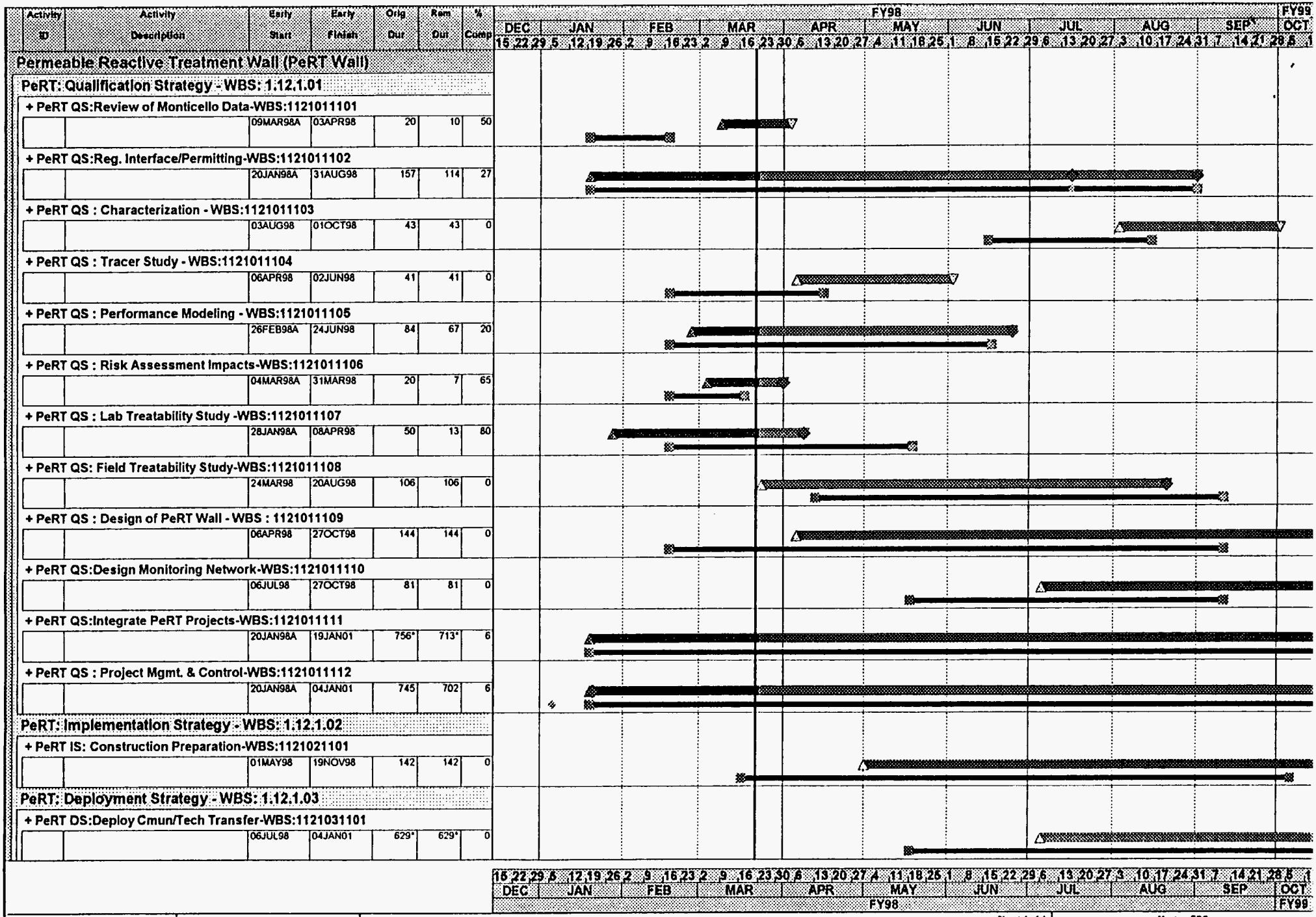
Vernon C. Cromwell
Project Manager

Enclosures

cc w/enclosures:
C. E. Carpenter, MACTEC–ERS
File: MSG1.6.2.2

cc w/o enclosures:
R. M. Plieness, DOE–GJO

vac\pert_ltr.epa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Activity Description
Early Start
Early Finish
Orig Dur
Rem Dur
% Comp
FY98
FY99
DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT
Permeable Reactive Treatment Wall (PeRT Wall)
PeRT: Qualification Strategy - WBS: 1.12.1.01
+ PeRT QS:Review of Monticello Data-WBS:1121011101
09MAR98A 03APR98 20 10 50
+ PeRT QS:Reg. Interface/Permitting-WBS:1121011102
20JAN98A 31AUG98 157 114 27
+ PeRT QS : Characterization - WBS:1121011103
03AUG98 01OCT98 43 43 0
+ PeRT QS : Tracer Study - WBS:1121011104
06APR98 02JUN98 41 41 0
+ PeRT QS : Performance Modeling - WBS:1121011105
26FEB98A 24JUN98 84 67 20
+ PeRT QS : Risk Assessment Impacts-WBS:1121011106
04MAR98A 31MAR98 20 7 65
+ PeRT QS : Lab Treatability Study -WBS:1121011107
28JAN98A 08APR98 50 13 80
+ PeRT QS: Field Treatability Study-WBS:1121011108
24MAR98 20AUG98 106 106 0
+ PeRT QS : Design of PeRT Wall - WBS : 1121011109
06APR98 27OCT98 144 144 0
+ PeRT QS:Design Monitoring Network-WBS:1121011110
06JUL98 27OCT98 81 81 0
+ PeRT QS:Integrate PeRT Projects-WBS:1121011111
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+ PeRT QS : Project Mgmt. & Control-WBS:1121011112
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PeRT: Implementation Strategy - WBS: 1.12.1.02
+ PeRT IS: Construction Preparation-WBS:1121021101
01MAY98 19NOV98 142 142 0
PeRT: Deployment Strategy - WBS: 1.12.1.03
+ PeRT DS:Deploy Cmun/Tech Transfer-WBS:1121031101
06JUL98 04JAN01 629* 629* 0
Project Start 01OCT96
Project Finish 26FEB01
Data Date 22MAR98
Run Date 30APR98
© Primavera Systems, Inc.
Early Bar
Target
Progress Bar
Critical Activity
PRTW
Sheet 1 of 1
UNITED STATES DEPARTMENT OF ENERGY
Deployment of a PeRT Wall
FY98 Work Package Summary Schedule
Mactec-ERS
Date Revision Checked Approved
4/30/98 AKB

Enclosure 1

Materials Testing

- Batch tests for sorbents
- Column tests for reductive precipitants

Enclosure 2

GJO

Reductive Precipitants

- Peerless ZVI
- Cercona ZVI
- Connelly ZVI
- Master Builder ZVI
- ZVI + limestone
- ZVI + dolomite
- ZVI + Cercona $Mg(OH)_2$
- ZVI + cement or concrete

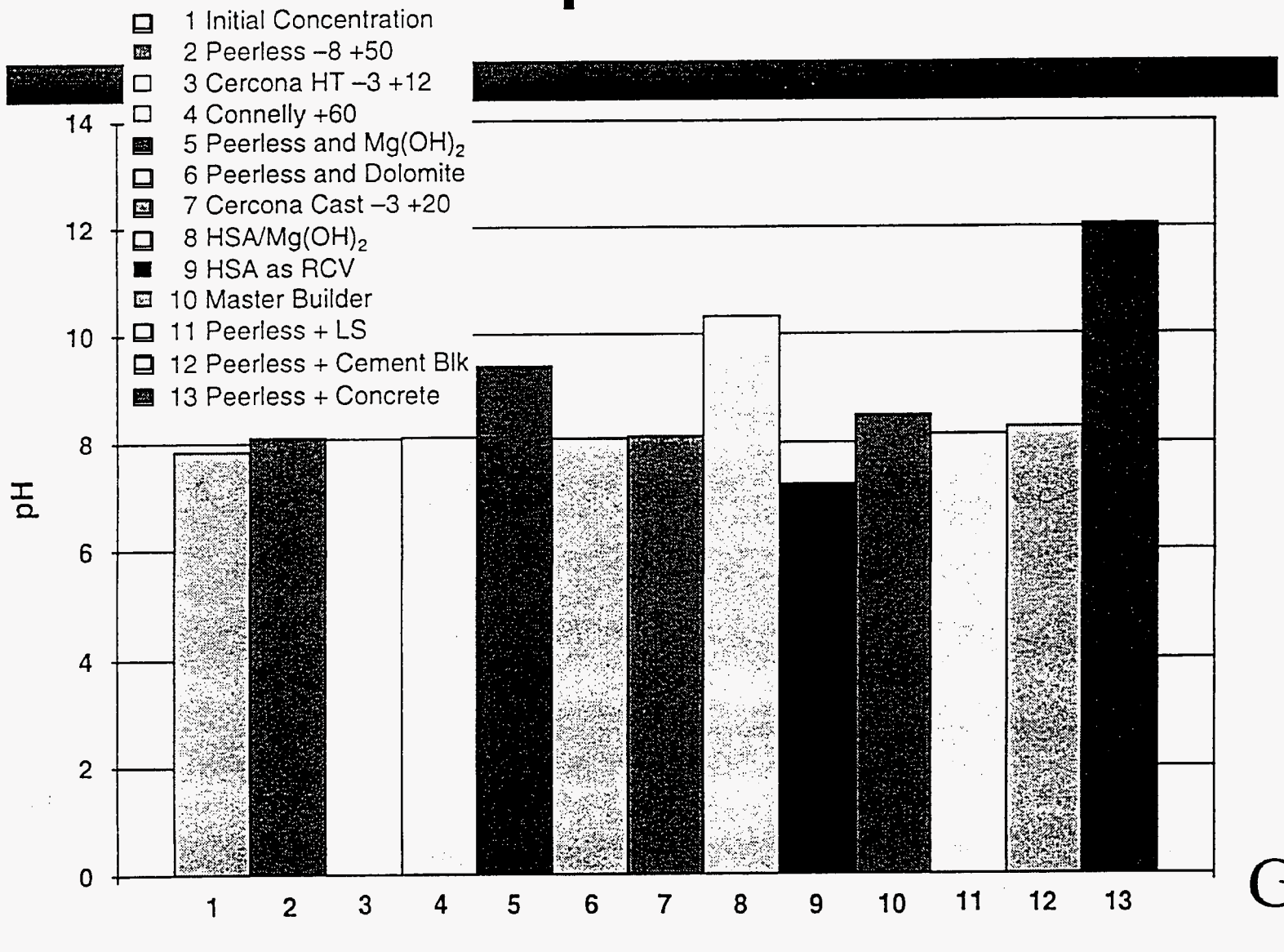
GJO

Sorbents

- Granular humate
- AFO/gravel
- AFO-coated hematite pellets
- AFO-coated glass foam
- Bone char
- Apatite (fish bones)
- GAC
- Peat
- Humasorb
- Ambersorb

GJO

pH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3 Cercona HT –3 +12
4 Connelly +60
5 Peerless and Mg(OH)2
6 Peerless and Dolomite
7 Cercona Cast –3 +20
8 HSA/Mg(OH)2
9 HSA as RCV
10 Master Builder
11 Peerless + LS
12 Peerless + Cement Blk
13 Peerless + Concrete
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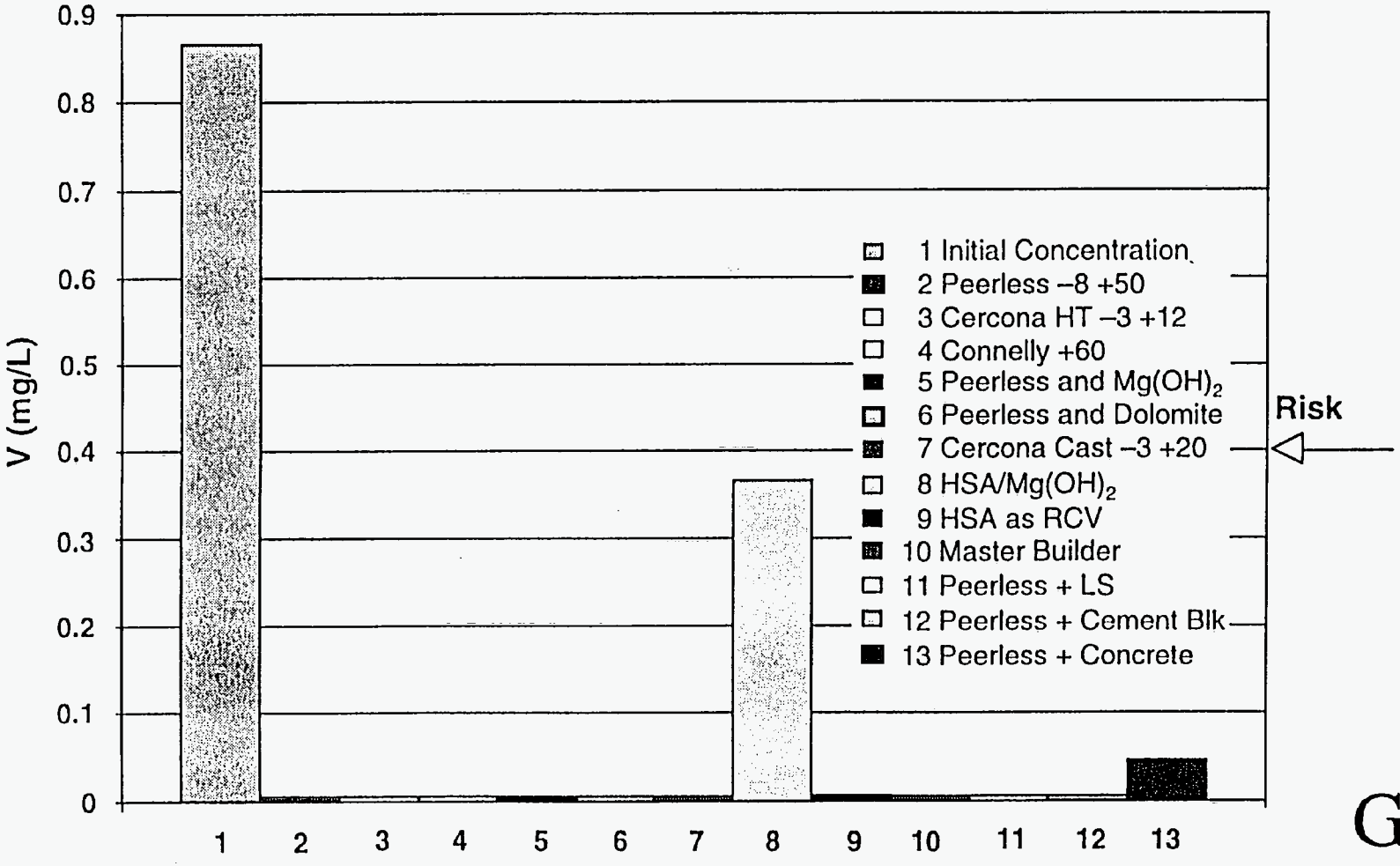
GJO

Vanadium



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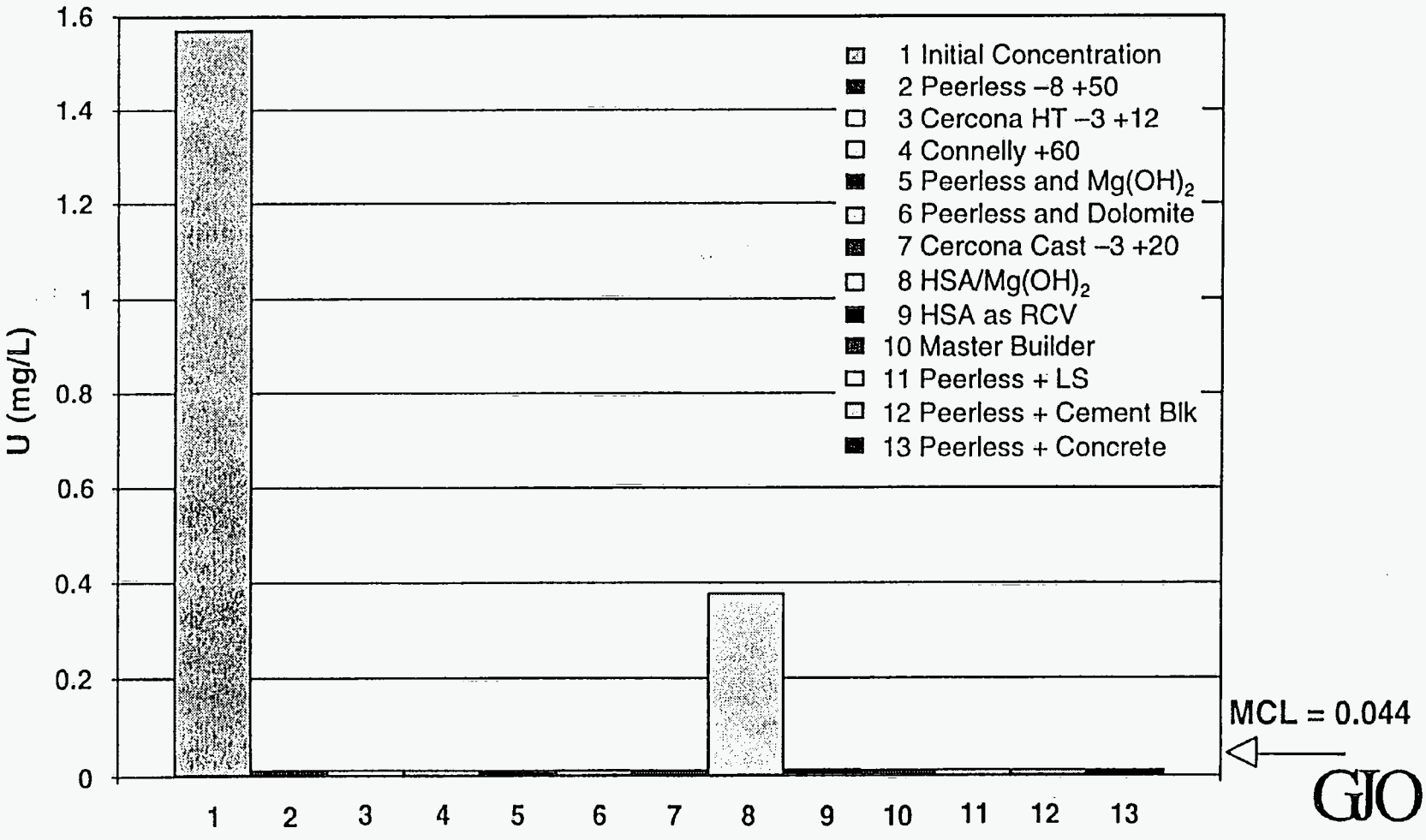
Uranium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U (mg/L)
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2 Peerless –8 +50
3 Cercona HT –3 +12
4 Connelly +60
5 Peerless and Mg(OH)2
6 Peerless and Dolomite
7 Cercona Cast –3 +20
8 HSA/Mg(OH)2
9 HSA as RCV
10 Master Builder
11 Peerless + LS
12 Peerless + Cement Blk
13 Peerless + Concrete
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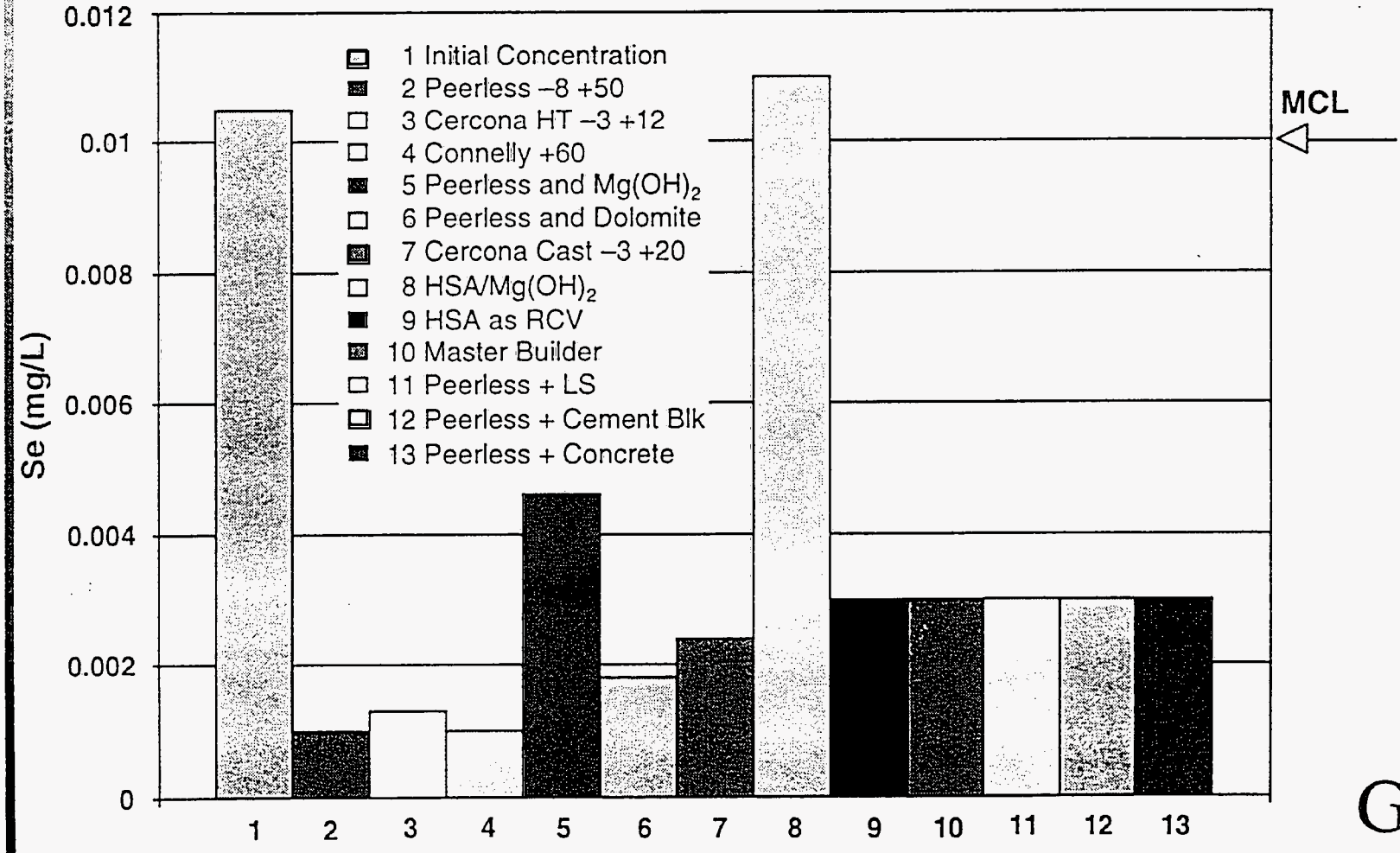
MCL = 0.044

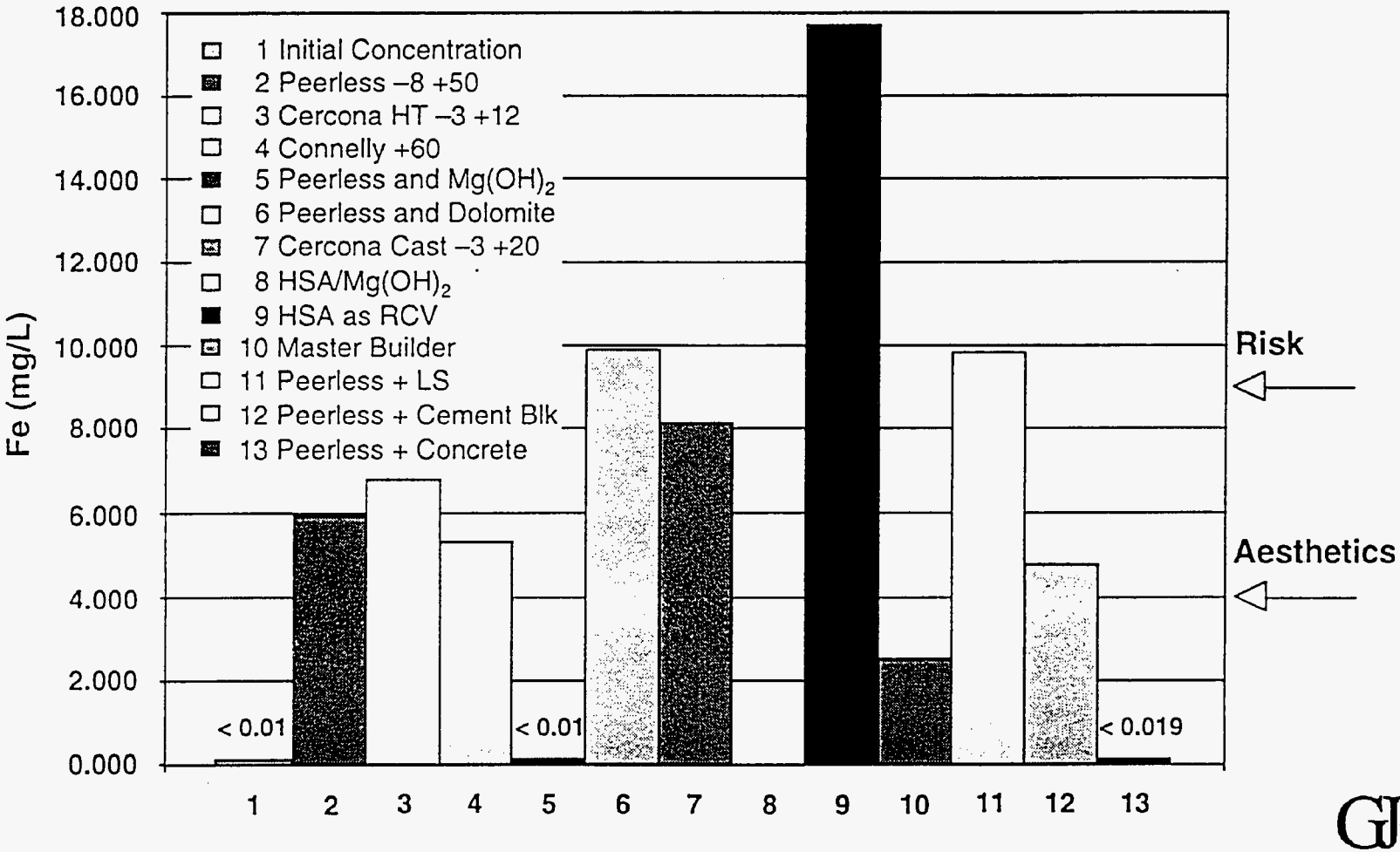
GJO

Selenium



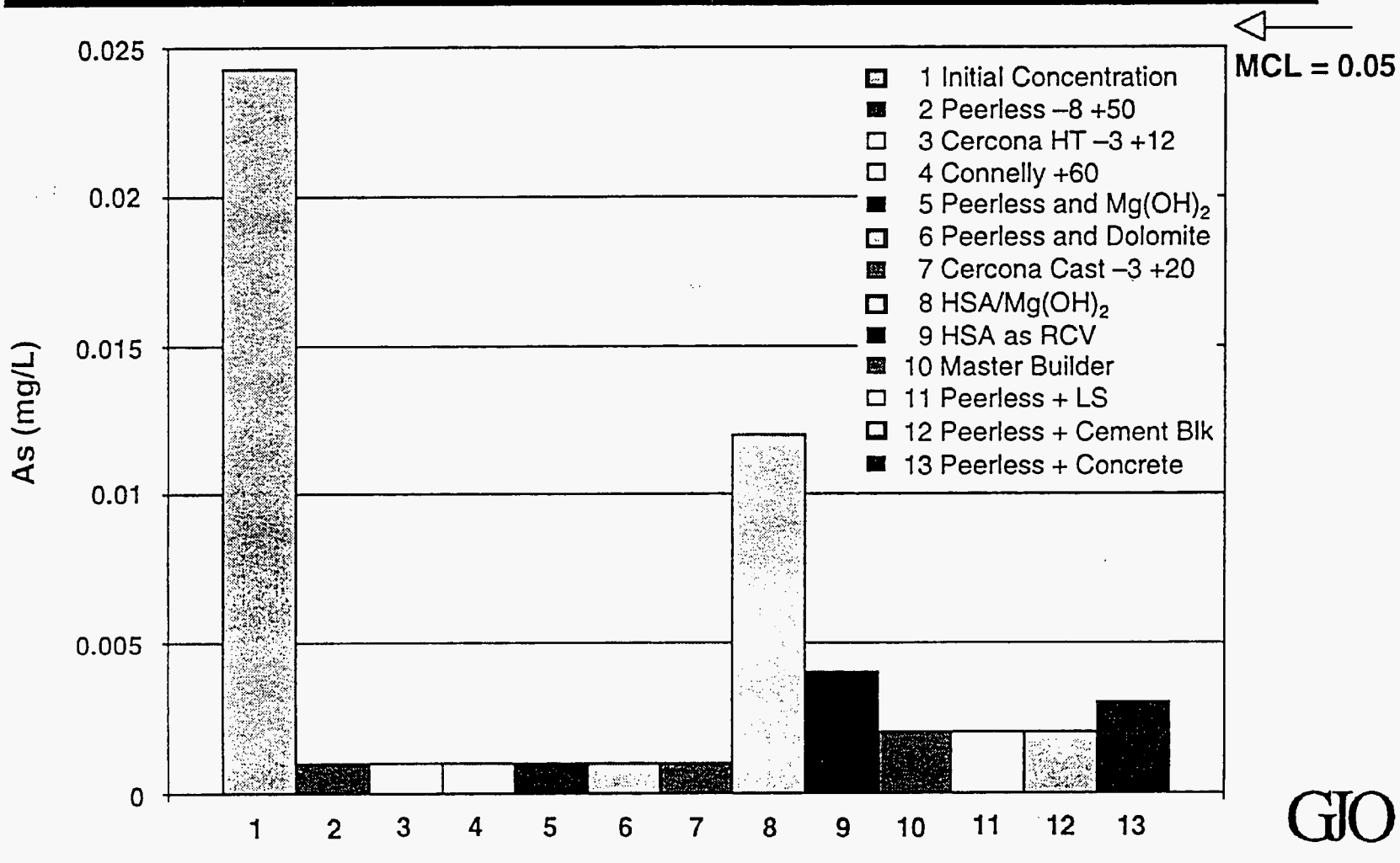
GJO

Dissolved Iron



GJO

Arsenic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0.02
0.015
0.01
0.005
0
As (mg/L)
1 Initial Concentration
2 Peerless –8 +50
3 Cercona HT –3 +12
4 Connelly +60
5 Peerless and Mg(OH)2
6 Peerless and Dolomite
7 Cercona Cast –3 +20
8 HSA/Mg(OH)2
9 HSA as RCV
10 Master Builder
11 Peerless + LS
12 Peerless + Cement Blk
13 Peerless + Concrete
1 2 3 4 5 6 7 8 9 10 11 12 13
MCL = 0.05

GJO

CHARACTERIZATION PLAN FOR MONTICELLO PeRT WALL PROJECT

May 1, 1998

Scope and Objectives:

Subsurface information is required in the vicinity of the proposed PeRT wall to more precisely delineate: (1) the direction of ground water flow in the alluvial aquifer, (2) the topography of the bedrock surface, (3) the textures and grain sizes of the alluvial gravels, (4) the extent of the ground-water plume (focus on uranium), and (5) the nature of the bedrock. Data from the characterization project will be used to determine the location of the PeRT wall and the emplacement method. For example, driven techniques such as sheet piling are more difficult in dense soils or strata with large cobbles. It is important to know the orientation of the bedrock surface to properly key into it and avoid flow under the wall. A more precise understanding of the plume geometry is needed to be certain that the wall will intercept all or most of the contamination. Currently, only sparse data are available in the vicinity of the PeRT with which to calibrate the ground water flow model. The flow model will be recalibrated using the results from the characterization program.

The orientation of the bedrock surface, water table elevations, and contaminant distributions are poorly known in the area (Area 1) north and northwest of the proposed PeRT wall. Area 2 has considerable information from prior characterization; however, confirmation drilling is necessary. Previous data suggest that alluvial ground water flows under Montezuma Creek in Area 3. This underflow is responsible for the contamination in well 92-07. Additional data collected in Area 3 will be used to design the PeRT wall so that it captures this portion of the ground-water plume.

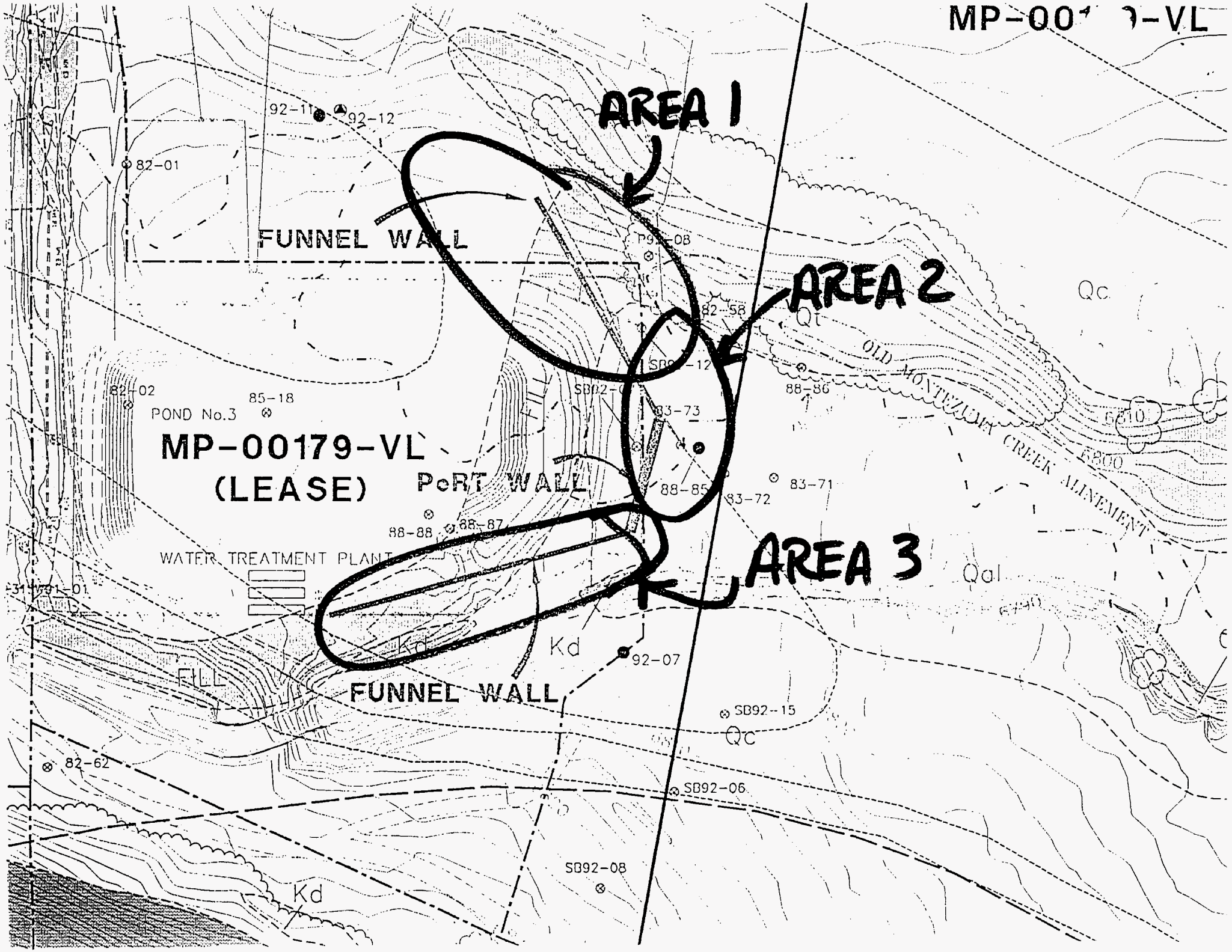
Work to Be Performed:

A Geoprobe will be used to penetrate from the ground surface to the bottom of the alluvial aquifer. The probe will be pushed into bedrock until refusal. A Geoprobe operates by vibrating a small diameter (1 inch) steel point into the ground. Cores can be retrieved and small diameter piezometers can be installed by this technique. In addition, a backhoe will be used to excavate to bedrock to allow direct observation of the alluvial gravels.

The Geoprobe technology has not been used at Monticello. If it is able to penetrate to the required depths, approximately 20 probes will be driven. Cores will be collected and examined for lithologic information. Temporary piezometers will be installed. All locations will be surveyed at the completion of the project. Efforts will be made to penetrate into the bedrock to retrieve samples. Approximately 8 probes will be driven in Area 1, 5 in Area 2, and 7 in Area 3.

Two trenches will be excavated to bedrock in Area 2. A sieve analysis will be performed on the excavated gravels and diameters of the largest cobbles will be measured. The excavations will be filled back in after the measurements are completed.

Water levels will be measured in each piezometer. Water samples will be collected and analyzed on site for uranium. Penetration rates of the Geoprobe will be determined and related to blow counts in adjacent wells (10 borings in the immediate vicinity have blow count information). Samples of the bedrock will be examined to determine the lithology (based on lithologic logs from previous drilling, it is expected that the bedrock is gray shale and siltstone of the Dakota Formation).


MP-00179-VL
AREA 1
AREA 2
AREA 3
FUNNEL WALL
POND No.3
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(LEASE)
PORT WALL
WATER TREATMENT PLANT
FILL
FUNNEL WALL
OLD MONTEZUMA CREEK ALIGNMENT
92-11
92-12
82-01
82-02
85-18
82-58
88-86
83-73
88-85
83-72
83-71
88-88
88-87
92-07
SB92-15
82-62
SB92-06
SB92-08
Qc
Qt
Qal
Kd

Field Column Tests for the TDI Project
Data Quality Objectives

April 29, 1998

The field column tests are intended to simulate the environment within the proposed permeable reactive treatment (PeRT) wall as accurately as possible prior to the installation. The results of these tests will be used to determine if the PeRT wall should be emplaced and if so what reactive material should be used. Contaminated groundwater will be extracted from a well in the immediate vicinity of the proposed installation and passed through a set of columns containing a variety of reactive media. The reactive media were selected based on their performance in laboratory column experiments. The field columns will be much larger in size than the laboratory columns. The larger size should lessen problems with dispersion, flow channeling, and ability to obtain large samples sizes suitable for chemical analysis, that complicate the smaller laboratory columns. The larger size also affords more solid media in which to directly observe mineral precipitation that might occur.

Data quality objectives for the field columns are as follows:

- To obtain large enough water samples from the column outflow so that they can be analyzed for all COCs, and any other analytes (e.g. Fe, dissolved O2, Eh, pH, electrical conductivity, alkalinity, total dissolved solids) that could be important to determining performance.
- To pass at least several hundred pore volumes through the columns so that at least one year of performance can be simulated.
- To use residence times of less than 2 hours which is much less than that expected in the PeRT wall. The residence time in a 10-foot barrier is expected to be about 12 hours. A partitioned column will be used to determine actual residence times which could be as short as 2 minutes. Longer residence times will also be used to better approximate the actual conditions in the PeRT wall: rate-controlled reactions (e.g. the decomposition of water) may react more with longer residence times causing unexpected changes.
- To evaluate the release of dissolved Fe.
- To evaluate the capture of COCs.
- To evaluate any associated pH or Eh changes which could cause a deleterious effect downgradient of the PeRT wall.
- To evaluate the amount of mineral precipitation that occurs in the reactive media.
- To determine the capacity, if any, of soils in the aquifer to stabilize released Fe.
- To determine if other reactants (such as magnesium hydroxide or glass foam) placed before or after the PeRT wall will have a beneficial effect, particularly on Fe release.
- To compare the performance of several commercial brands of zero-valent iron reactive media.
- To monitor backpressures as an indication of clogging.

MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: MAC98-12
CONTROL NO.:

MEMO TO: Permeable Reactive Treatment (PeRT) Wall File

FROM: Clay Carpenter CEC

DATE: March 31, 1998

SUBJECT: Potential Reduction in Risks to Human Health From Use of the PeRT Wall

The purpose of this memo is to evaluate the anticipated reduction in risks to human health associated with reduced contaminant concentrations from the PeRT wall. A baseline risk assessment has been prepared for this site that follows the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidelines. This risk assessment will serve as the basis for the anticipated risks, which can then be compared to the expected risks associated with PeRT wall treated groundwater.

The baseline risk assessment reached the following conclusions:

- No exposure is currently occurring to the alluvial groundwater.
- Future exposure is possible, although unlikely. Nevertheless, it was assumed future exposures will occur based on CERCLA guidelines.
- Future exposures and risks were estimated using groundwater modeling to predict future exposure point concentrations. Exposure was assumed to occur in the vicinity of well 92-11 in 10 years.
- The quantifiable contaminants of concern (COCs) for groundwater are arsenic, lead-210, radium-226, uranium-234, uranium-235, uranium-238, elemental uranium, manganese, selenium, and vanadium.
- Based on the above assumptions, future risks will be unacceptable based on guidelines specified in the National Contingency Plan (NCP). In general, the NCP indicates that carcinogenic risks greater than 1×10^{-4} and noncarcinogens risks, expressed in terms of a hazard index (HI), greater than 1 are unacceptable. Because of the different toxicological impacts of contaminants on human health, the (COCs) need to be organized into the following three categories: (1) nonradionuclide carcinogens (arsenic), (2) radionuclide carcinogens (lead-210, radium-226, uranium-234, uranium-235, and uranium-238), and (3) noncarcinogens (arsenic, manganese, selenium, uranium, and vanadium). Note that a contaminant (e.g., arsenic) may have multiple impacts that must be included in more than one category. An

overall summary of the results (assuming reasonable maximum exposure parameters) is presented below:

	Estimated Future Risks from Groundwater Ingestion	CERCLA Benchmark	Ratio of Risks/CERCLA Benchmark
Nonradionuclide Carcinogens	4.2×10^{-4}	1×10^{-4}	4.2
Radionuclide Carcinogens	3.7×10^{-4}	1×10^{-4}	3.7
Noncarcinogens	10	1	10

Laboratory treatability tests have begun for the PeRT Wall Project at Monticello using water extracted from well 92–11. Several materials have been evaluated in the laboratory treatability studies. The type of material that will be used in the PeRT wall has not been selected. However, for the purposes of estimating risks, it was assumed that Peerless –8 +50 mesh zero valent iron would be used. This is a likely candidate and it shows a similar reduction in concentrations with other materials that may be selected. Table 1 summarizes the concentration information for the groundwater COCs. There are no laboratory treatability results for Pb-210 and Ra-226. Pb-210 concentrations will be available later in the project. Elevated concentrations of Ra-226 have not yet reached well 92–11 (the baseline risk assessment used modeled future concentrations). It is anticipated that the concentrations of Ra-226 will be reduced when the plume reaches the PeRT wall but the extent of the reduction is unknown. However, even based on no reduction, Ra-226 is not a significant contributor to the total risks.

Table 2 presents the estimated risks from the baseline risk assessment compared to the risks associated with the expected contaminant concentrations exiting the PeRT wall. This table shows that substantial reductions in risks will occur for all the COCs evaluated. The carcinogens would no longer have a risk greater than 1×10^{-4} and the HI for the noncarcinogens is less than 1.

Table 1. Summary of Groundwater Concentration Data

Quantifiable COCs	Concentration Used in the Baseline Risk Assessment[a]	Lab Treatability Concentration	Derived Concentration
Arsenic (ug/l)	20.3	1.0	–
Manganese (ug/l)	2,750.8	505	–
Selenium (µg/l)	19.3	1.0	–
Elemental Uranium (µg/l)	351.6	1.0	–
Vanadium (µg/l)	691.2	2.6	–
Pb-210 (pCi/L)	6.9	NA	NA
Ra-226 (pCi/L)	1.1	NA	NA
U-234 (pCi/L)	117.8	NA	0.34[b]
U-235 (pCi/L)	5.6	NA	0.02[b]
U-238 (pCi/L)	117.8	NA	0.34

[a]These are estimated future exposure point concentrations in 10 years at well 92–11.
[b]The same reduction achieved with elemental uranium was assumed for the isotopes (99.7%).

Table 2. Risk Comparison Based on the Ingestion of Contaminated Groundwater Only

	Added Cancer Risk—Nonradionuclides		
	Baseline Risk Assessment	Based on Likely Concentrations Exiting the PeRT Wall	Percent Reduction
Arsenic	4.2×10^{-4}	2.1×10^{-5}	95.1
	Added Cancer Risk—Radionuclides		
Uranium-234	9.3×10^{-5}	2.6×10^{-7}	99.7
Uranium-235	5.2×10^{-6}	1.5×10^{-8}	99.7
Uranium-238	1.2×10^{-4}	3.4×10^{-7}	99.7
Total	2.18×10^{-4}	6.15×10^{-7}	99.7
	Noncarcinogenic Risks		
Arsenic	2.2	0.11	95.1
Manganese	0.639	0.12	81.6
Selenium	0.125	0.006	94.8
Uranium	3.81	0.011	99.7
Vanadium	3.21	0.012	99.6
Total	10.0	0.26	97.4

Pert flow modeling approach and summary to date:

Groundwater flow modeling is being performed to evaluate capture effectiveness and aquifer response to a variety of funnel and gate-type PeRT system designs. The groundwater flow model developed under the MMTS OU III Remedial Investigation (RI) was adopted, with slight modification, as the baseline flow condition used in the evaluation.

The RI flow model was modified as follows: (1) drain cells in the western portion of the millsite were eliminated, (2) the areal recharge rate along the northwest margin of the millsite was reduced to compensate for drain cell removal, (3) model cells east of well 95-01 are beyond the influence of the PeRT system and were deactivated to improve model efficiency, (4) grid cell dimensions in the PeRT area were reduced from 100 x 50 ft (east-west by north-south) to 50 x 50 ft and 25 x 50 ft to improve head resolution, and (5) conductances in river and general head cells affected by grid refinement were adjusted to match boundary fluxes prior to grid refinement. Flow conditions of the resulting model were essentially identical to those of the original RI model, with slight improvement in head calibration.

The flow modeling uses the computer program Visual MODFLOW, a pre- and post-processing environment for MODFLOW (numerical flow model) and MODPATH (particle tracking model). Within the baseline flow model, various configurations of the PeRT system are specified according to preliminary designs; flow is simulated under steady state conditions. The PeRT area includes the central portion of the alluvial aquifer approximately 625 ft east of the millsite, which is immediately east of Pond 3. Variables currently being evaluated are length and orientation of funnel walls, hydraulic conductivity of the gate, and length of the gate perpendicular to groundwater flow. Capture is evaluated by forward particle tracking analysis (MODPATH) and zonal water balance analysis (MODFLOW).

The modeling conducted to date has shown that groundwater flowing north of the permeable gate is relatively easily captured by funnel sections extending about 100 to 150 ft north to northwest. Significant bypass of potentially contaminated groundwater is predicted south of the gate when funnel sections extend 100 to 150 ft southwest of the gate on the north side of Montezuma Creek. Groundwater flux through the gate ranges between approximately 21 and 32 gallons per minute under these scenarios. The corresponding hydraulic heads are predicted to increase in the area immediately upgradient of the PeRT system by several feet. Downgradient of the PeRT system, hydraulic heads are not predicted to change significantly from baseline conditions.

OU III AR 569a

4-5-9

U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503
SEP 29 1998

Mr. Paul Mushovic
Environmental Protection Agency, Region VIII
Suite 500, Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
168 North 1950 West
Salt Lake City, UT 84116

Subject: Containment of Purge Water from Bedrock Monitoring Wells in Regard to the Monticello Mill Tailings Site Operable Unit III Annual Monitoring Program

Dear Mr. Mushovic and Mr. Bird:

Ground water samples have been collected and analyzed for organic and inorganic constituents routinely since November 1992 as part of the OU III Remedial Investigation. In accordance with procedures specified in the OU III ground water sampling and analysis plans, purge water from bedrock wells, on and down gradient of the millsite, has been collected and disposed for treatment at the millsite water treatment plant. This was done to prevent redistributing contaminants from ground water to soil in the area surrounding the monitoring wells. However, the sample analytical results obtained to-date demonstrate that bedrock ground water is not contaminated. The practice of containing and treating purge water from the bedrock monitoring wells is therefore unnecessary. Beginning in October 1998, DOE proposes to discharge purge water from each bedrock well to the ground in the vicinity of the well in a manner that will not create a muddy work area. DOE will review the sample results from each round; if the results indicate that the ground water has become contaminated, the purge water will again be contained and treated.

If this proposed change is not acceptable, we would appreciate notification prior to the next ground water sampling round which is scheduled to begin October 6, 1998. If you have any questions, please feel free to call me at (970) 248-7612.

Sincerely,

Donald R. Metzler
Technical/Project Manager

cc:
M. C. Butherus, MACTEC-ERS
Project File: MSG1.6.2.2 DOE

drm\amt.mem

4-5-10

OU111 AR 569a

U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
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NOV 05 1998

Mr. Paul Mushovic
Environmental Protection Agency, Region VIII
Suite 500, Mail Stop 8HWM-FF
999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Monticello Permeable Reactive Treatment (PeRT) Wall 60 Percent Design, Site Characterization Report, and Response to 30 Percent Design Comments

Dear Mr. Mushovic and Mr. Bird:

The enclosed documents are forwarded for your review. Comments would be appreciated by November 18 to maintain that aggressive design/build schedule. Our goal is to have a superior approved design by mid-December. This would allow the procurement cycle to be completed during the winter. The advantage to this schedule would be emplacement of the PeRT Wall before the spring monsoons can result in high ground water flows, muddy construction site conditions, and increased lightning hazards during the sheet piling installation.

The 60 percent design incorporates your comments and includes the following substantive changes:

1. The location of Montezuma Creek will be relocated north of the PeRT Wall gate location, which has changed the access road and staging area for the construction site.

2. The relocation of the Creek to cross upgradient of the PeRT Wall provides a natural hydrologic means to deal with any mounding associated with transient high water tables. Therefore, the by-pass system shown in the 30 percent design is no longer needed.

The Characterization Report details results of site investigations and ground water modeling. Figures in the report were developed before the determination to move the Creek was finalized and included the location of the PeRT Wall from the 30 percent design. It was determined that, for the purposes of characterizing the existing hydrologic and geologic conditions at the site,

changing the location of the PeRT Wall on those figures was not important. The final location of the PeRT Wall gate and impermeable wings will be specified in the final design based on technical input and any site surface feature constraints at the time of construction.

Please contact me at 970/248-7735 after you receive these materials if you are unable to prioritize the expedited review. We will jointly determine an acceptable means to maintain the proposed construction schedule.

Sincerely,

Vernon A. Cromwell
Project Manager

Enclosures:
1. 60 Percent Design Specification
2. Characterization Report
3. Response to UDEQ Comments

cc w/o enclosures:
R. Plieness, DOE-GJO
C. Carpenter, MACTEC-ERS
Administrative Record File
File PTW1.8 (D. Dupont)

vac\60%trans.doc

4-5-1

OUIII AR 569a

U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
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FEB 1 3 2001

Mr. Paul Mushovic
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999 18th Street, Denver Place
Denver, CO 80202-2405

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environment Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Addition of Appendix C to the *MMTS OUIII Interim Remedial Action Surface Water and Ground Water Monitoring Plan*, Revision 4

Dear Mr. Mushovic and Mr. Bird:

Enclosed are two sets of Appendix C for inclusion into your copies of the IRA Surface Water and Ground Water Monitoring Plan. The appendix was inadvertently not copied during document assembly. Please insert the appendix into the subject document.

If you have any questions, please contact me at (970) 248-7612.

Sincerely,

Donald R. Metzler
Technical/Project Manager

Enclosure (2)

cc w/o enclosure:
M. Butherus, MACTEC-ERS
Project Record MSG 1.3.5 (thru J. Glasgow)
Information Repository-2 copies (thru Tom Kirkpatrick)

drm/appcira.doc

4-5-12

OU III AR 569a

U.S. Department of Energy
Grand Junction Office
2597 B¾ Road
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APR 12 2002

Mr. Paul Mushovic
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Suite 300, Mail Stop 8EPR-F
Denver, CO 80202-2466

Mr. David Bird
State of Utah Department of Environmental Quality
Division of Environmental Response and Remediation
168 North 1950 West
Salt Lake City, UT 84116

Subject: Transmittal of a Position Paper on Selenium–Operable Unit III, Monticello, Utah

Dear Mr. Mushovic and Mr. Bird:

Enclosed are two copies of a position paper on selenium as a "Contaminant of Concern" for Operable Unit III. The DOE would like to discuss this with you during the May 14 and 15 Operable Unit III technical meeting. If you have any questions, please call me at (970) 248-6020.

Sincerely,

Joel Berwick

Joel Berwick
Project Manager

Enclosures

cc w/o enclosure:
M. Butherus, MACTEC-ERS
K. McClellen, MACTEC-ERS

cc w/enclosure:
Project File MSG 1.6.2.2 (DOE)

jdb\selenium2.doc

Selenium in OU III Surface Water and Ground Water

The paper is organized into three parts. The first part summarizes results of investigative activities and other information on selenium that has been presented in documents and white papers and discussed at FFA and OU III technical meetings through to November 2001. The second part of this paper summarizes DOEs current understanding of the selenium levels in surface and ground water. The third part presents DOEs recommendation and proposal for monitoring selenium.

Monticello Mill Tailings Site, Operable Unit III, Remedial Investigation (DOE 1998)
Selenium was identified during the remedial investigation as a potential contaminant of concern because it was consistently detected above background levels in ground water on and downgradient of the Millsite. The 95 percent upper confidence limit (UCL_{95}) of the mean for selenium in ground water was 2.8 µg/L upgradient of the site, 25.7 µg/L on site, and 13.7 µg/L downgradient of the site as reported in the Remedial Investigation Report (DOE 1998). Selenium was also monitored in Montezuma Creek and seep locations during the RI. The UCL_{95} for selenium in surface water was 2.3 µg/L upstream of the site, 65 µg/L on site, and 4.5 µg/L downstream of the site in Upper Montezuma Creek.

The effects of selenium were assessed in the ecological risk assessment (ERA). Hazard quotients (HQs) for surface water were calculated by comparing surface water concentrations to the State of Utah Aquatic Wildlife Criteria of 5 µg/L. The HQs for Upper, Middle, and Lower Montezuma Creek were all less than one. Although the ERA concluded that, "only impacts to the aquatic community may be of possible concern," the finding of a "possible concern" was not due to selenium levels in abiotic media. The ERA also concluded "there is little likelihood that the OU III COCs are negatively affecting the other receptors."

In the Human Health Risk Assessment, selenium was identified as a contaminant of potential concern (COPC) in both ground water and surface water. Selenium was eliminated as a COPC in surface water because the chronic daily intake computed using the UCL_{95} did not exceed published guidelines recognizing that selenium is a nutrient essential to human health. The HQs for selenium were calculated using a residential ground water ingestion scenario. The reasonable maximum exposure and central tendency HQs were 0.125 and 0.065, respectively. These HQs indicated that selenium is not a significant contributor to risk from ingestion of contaminated ground water.

Post RI Quarterly Monitoring
Although the RI showed that selenium was not a significant risk driver at the site, it was retained as an analyte in the monitoring program after the RI because of the unknown effects of millsite remediation on surface water and ground water. During routine data analysis it became evident that selenium concentrations were increasing. Looking at time-concentration plots (discussed later), it is evident that at a few wells, the increase first began in April 1999. It should be noted that the majority of contaminated soils had been removed from the millsite by this time.

September 2000, FFA Meeting
DOE reported the significant increase in selenium concentrations at some monitoring wells and some surface water sites. Possible reasons for the increase discussed at the FFA were (1) high selenium levels in soil imported for backfill, (2) selenium presence in elk or cattle feed, (3) high

selenium levels in irrigation water, and/or (4) selenium leaching from newly exposed bedrock areas on the millsite.

December 2000, OU III Technical Meeting
DOE took an action to investigate the increase in selenium concentrations by following up on possible explanations put forth at the September FFA and to sample sewage treatment plant effluent if it was determined if anyone was using it for irrigation.

April 2001, Nitrate and Selenium White Paper
This paper addressed the action items from the September 2000 and December 2000 meetings. Backfill material as a source of the selenium was discounted because the loess-derived soils used for backfill are not marine deposited Upper Cretaceous or Tertiary marine sedimentary deposits. Selenium in elk feed and from irrigation water were discounted because the pattern of contamination in the ground water is not consistent with their usage.

Elevated concentrations of selenium in Mancos Shale and the coaly, carbonaceous part of the Dakota Sandstone, are well documented. During millsite remediation, from early September 1998 to late October 1998, a considerable portion of exposed unweathered bedrock was thoroughly washed to remove contamination. Since middle 1998 and up to late 2000, large areas of newly exposed Dakota Sandstone and Mancos Shale were covered with numerous ponds (the East Pond being the largest) and subject to leaching by pond water, precipitation, runoff, and Montezuma Creek flows. In addition, it should be noted that fertilizer application on the millsite began in April 1998 and continued through April 2000.

DOE hypothesized that bedrock exposure to air and water allowed selenium-containing sulfide minerals in unweathered portion of the formations to be oxidized, allowing selenium to be released into solution. The leaching was likely aided by nitrate fertilizer application, enhancing the oxidizing condition of the ground water. The increase in selenium concentrations in alluvial wells downgradient of the millsite began in April 1999 approximately 6 months after large areas of Dakota Sandstone and Mancos Shale were first exposed on the millsite. The largest increase in selenium concentration has occurred at well 92-11. DOE recommended that no further investigation into the selenium source be conducted at that time and stated that selenium would continued to be monitored as part of the sampling program.

June 2001, OU III Technical Meeting
The nitrate and selenium white paper was discussed. It was generally agreed that increasing levels of selenium were most likely due to weathering/washing of exposed bedrock during remediation. DOE took action items to (1) review millsite verification sample data to determine the levels of selenium in soil left in place, (2) review selenium levels in historical ground water data from the millsite, and (3) conduct a literature review for sources and effects of selenium. The possibility of running additional analysis on samples of millsite NORM material collected by ORNL/Aimtech and additional batch tests for selenium leaching on bedrock samples were discussed as a future possibility.

August 2001 Selenium Technical Papers Submittal
DOE completed action item (3) above by sending technical papers addressing naturally occurring selenium in western United States soils and water.

October 29, 2001 Information Transmittal
Prior to the FFA meeting scheduled for November 2001, DOE completed the action items identified in June 2001 and transmitted that information to EPA and UDEQ. Selenium information included in the transmittal is summarized in the following paragraphs.

Review of 287 verification samples showed that most results are within the range of 0.2 to 0.4 mg/kg. 63 results exceed 0.4 mg/kg; of these results 18 are greater than 1.0 mg/kg. No clear pattern exists with regard to higher levels being associated with bedrock, however, most subsoil on the site is derived from local bedrock parent material (Mancos Shale and Dakota residuum).

Surface Water Upstream of the millsite, Mancos Shale and Dakota Sandstone do not crop out within the creek channel although these units are encountered at depths between 12 and 16 feet below ground surface in the vicinity of the golf course. Selenium is generally not detected upstream of the millsite in Montezuma Creek and historically was not detected in the Upper North Drainage seep area. The highest concentrations of selenium have been associated with seep sampling. Historically, the pile seeps ranged from close to the standard to as high as 3,110 µg/L. Discharge from these seeps to Montezuma Creek was eliminated after the October 1994 sampling event. Currently, selenium concentrations are greatest at Seeps 2 and 3 in the north and eastern part of the millsite where concentrations range from 86.4 to 221 µg/L.

On the millsite, samples from Montezuma Creek historically ranged from levels below the standard to a high of 12.0 µg/L. Currently, sampling at the culvert on the east end of the millsite shows that selenium levels range from 7 to 9 µg/L.

Downstream of the millsite, samples from Montezuma Creek at W-4 on Sommerville's property ranged from below the standard to as high as 42 µg/L prior to 1992. In 1994, concentrations at W-4 averaged around 10 µg/L. Since that time they dropped to low or non detect values until sampling was discontinued in April 1999 due to remediation of the property. At all other sampling locations downstream of the millsite, selenium concentrations are variable ranging from non detect to a high of 11.7 µg/L during the last 20 years. Concentrations generally doubled beginning with the April 2000 sampling event from previous levels averaging 3 to 4 µg/L. There is no current significant trend (i.e., concentrations appear to have stabilized at levels between 6 µg/L and 10 µg/L).

Ground Water Selenium is not consistently detected in Burro Canyon or Dakota Sandstone ground water. When selenium is measured, concentrations are below 10 µg/L.

Selenium is usually detected in wells completed in the Mancos Shale. Concentrations are usually below 20 µg/L, however at one offsite well (05NW89-049-4), selenium consistently exceeded the standard. Concentrations at this well have ranged from 75.3 µg/L to 114 µg/L.

In alluvial ground water upgradient of the millsite, selenium concentrations are low ranging from non detect to about 2 µg/L. On and downgradient of the millsite, selenium concentrations have fluctuated widely during the past 20 years. The recent increase began in April 1999. At well 92-11 selenium concentrations increased to a maximum observed in the ground water of 197 ug/L. Currently, concentrations offsite and upgradient of the PeRT wall range from about

50 to 120 µg/L. Selenium concentrations are reduced to non detect or near non detect levels by the PeRT wall. Downgradient of the PeRT wall concentrations are generally below the 50 µg/L standard except at well 92-08 where they varied inconsistently between 33 and 123 µg/L during the last year.

November 2001 FFA Meeting
The increased level of selenium in surface water and ground water was discussed with Mark Novack and Bill Moellmer of the Utah Division of Water Quality. Everyone involved in the discussion was well aware that soils that develop from Cretaceous-age marine units in the western United States often contain elevated levels of selenium. DOE took an action to prepare a position paper discussing (1) data trends, (2) a comparison of OU III surface water and ground water to creeks or ground water in the area, (3) the results of seep sampling, (4) an explanation of the effect of the PeRT wall on selenium removal, and the planned monitoring and compliance strategy for selenium.

(1) Trends in selenium data are shown in the time-concentration plots shown in Figures 1 to 5. Overall, selenium concentrations in ground water and surface water appear to have stabilized from the increasing trend begun in April 1999 and at some wells and surface water locations there is a trend toward decreasing concentrations.

In Montezuma Creek upstream and onsite, selenium concentrations have been low (below the 5 µg/L aquatic wildlife criteria) at all locations except for SW00-02 at the eastern boundary of the millsite (Figure 1). The elevated levels at this location are likely the result of surface flow of seep water entering the creek and some ground water discharge to surface water. The most recent sampling result from this location indicates that surface water concentrations have dropped since October 2001. Downstream of the site, concentrations appear to have stabilized and perhaps are beginning to show a downward trend (Figure 2).

The concentration of selenium in upgradient and onsite ground water is shown in Figure 3. Selenium levels are low upgradient of the site and in the western half of the millsite. About midway between Wetland 2 and Wetland 3 (well T01-12) concentrations begin to increase. Prior to millsite remediation, selenium concentrations were about 20 µg/L in the eastern half of the millsite. Although these levels are currently exceeded, concentrations have begun to decrease at some wells (T01-07 and T01-12). Downgradient of the site (Figure 4) and upgradient of the PeRT wall, concentrations appear to have peaked in July 2001; however, until the April and July 2002 samples are collected and compared to 2001 data, this trend may be due to seasonal fluctuations. Downgradient of the PeRT wall, concentrations may have peaked in April 2000 (Figure 5).

(2) The October 2001 transmittal contained information comparing OU III ground water to ground water in unaffected areas (see above).

Prior to the seep sampling that was accomplished in February 2002, surface water data from areas surrounding the millsite consisted of that from upstream of the site (as previously summarized), from Verdure Creek, a single sample from Deer Draw, and a few samples taken from seeps north east of the millsite. Selenium concentrations at these locations are generally non detect or are low (less than 5 µg/L).

Figure 1

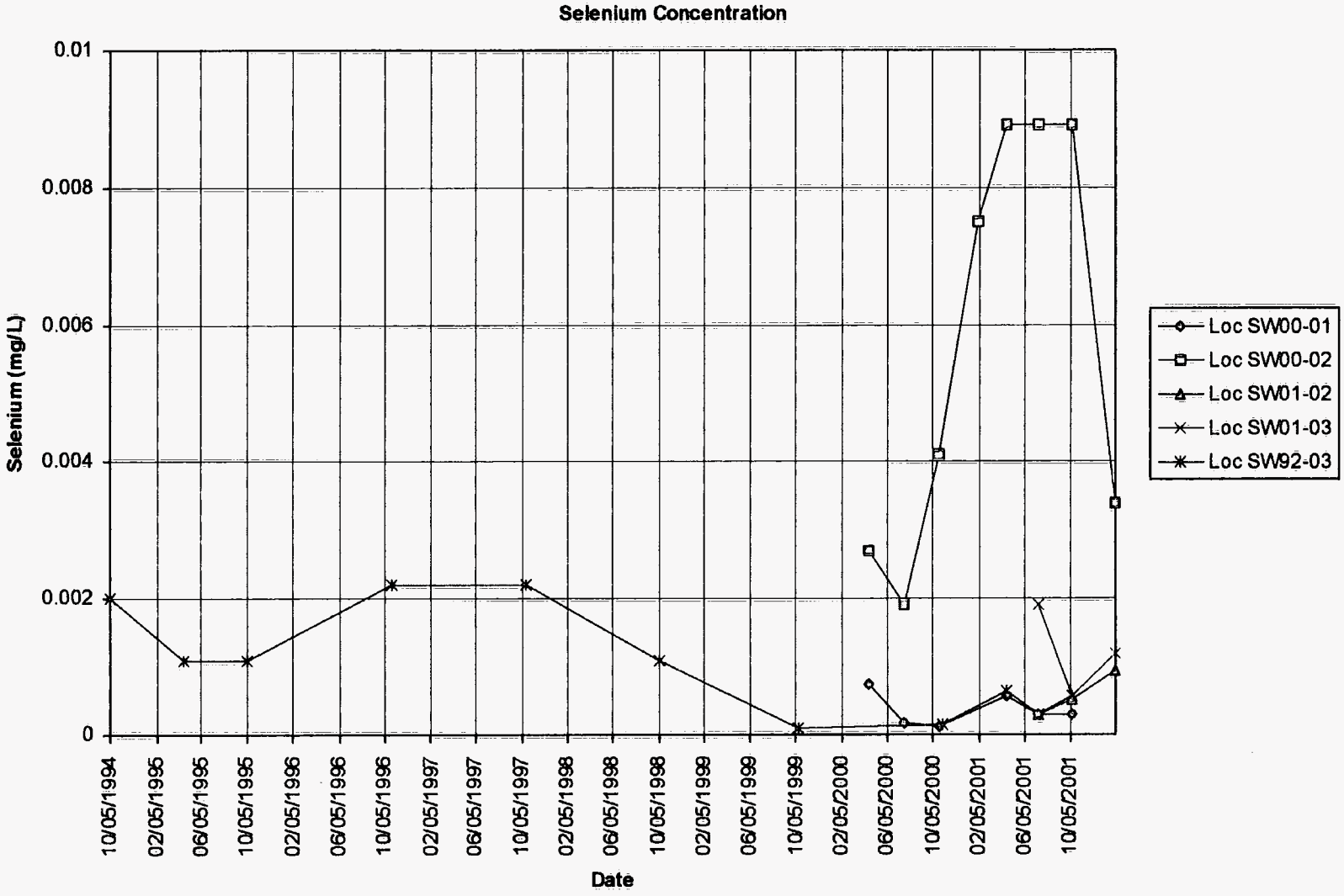

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Figure 2

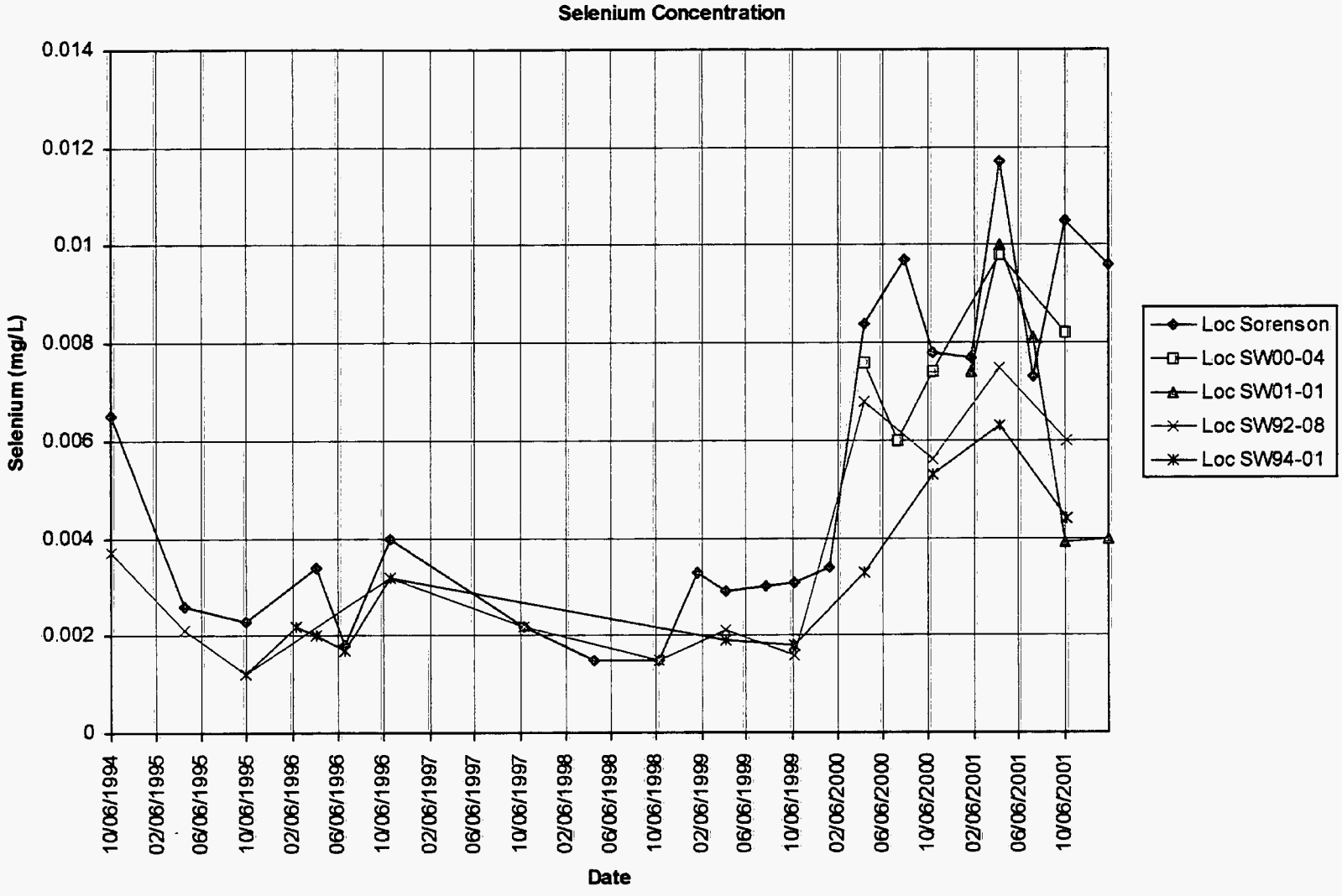

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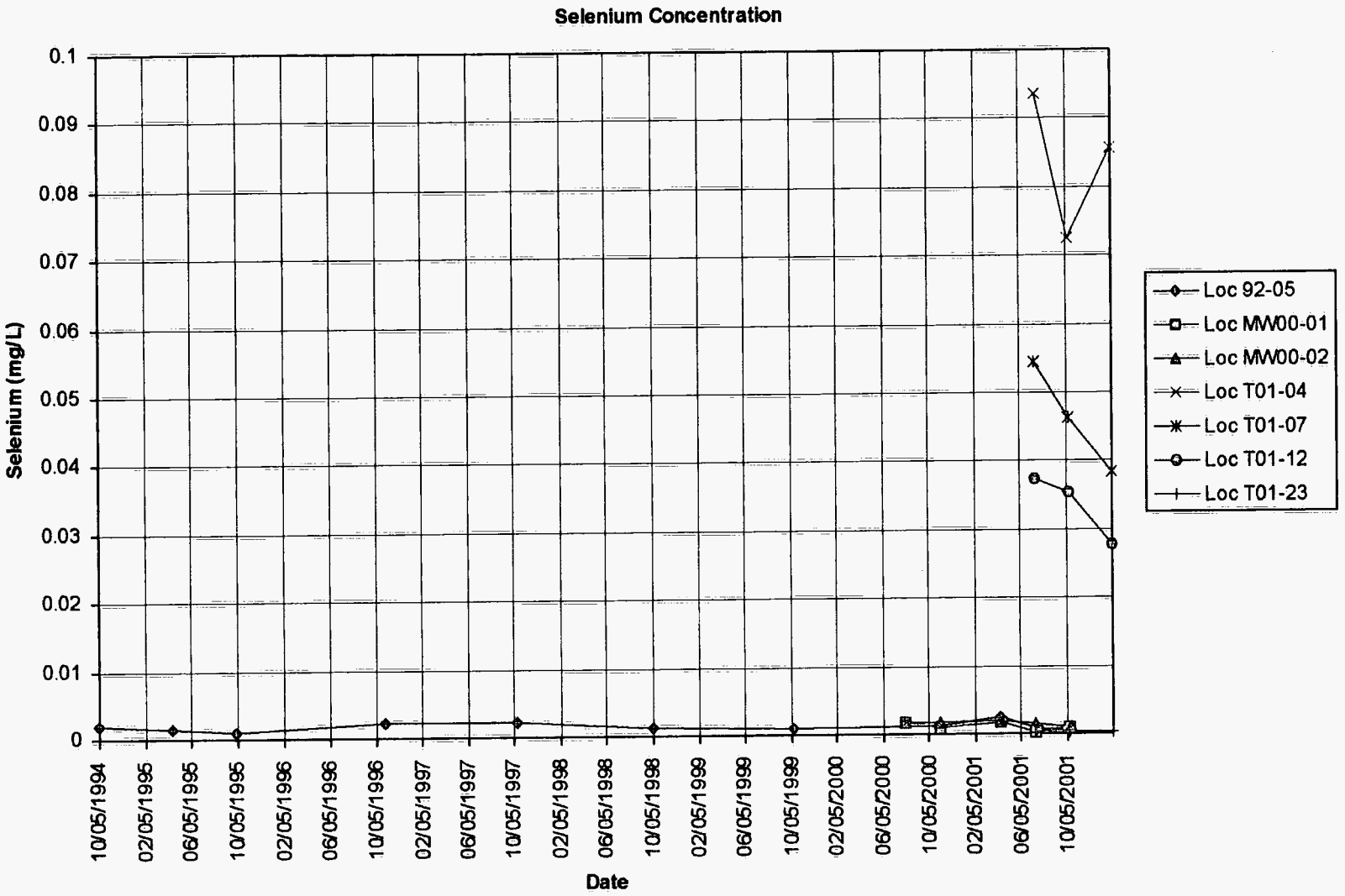
Figure 3



4/9/2002 9:00 am

Figure 4

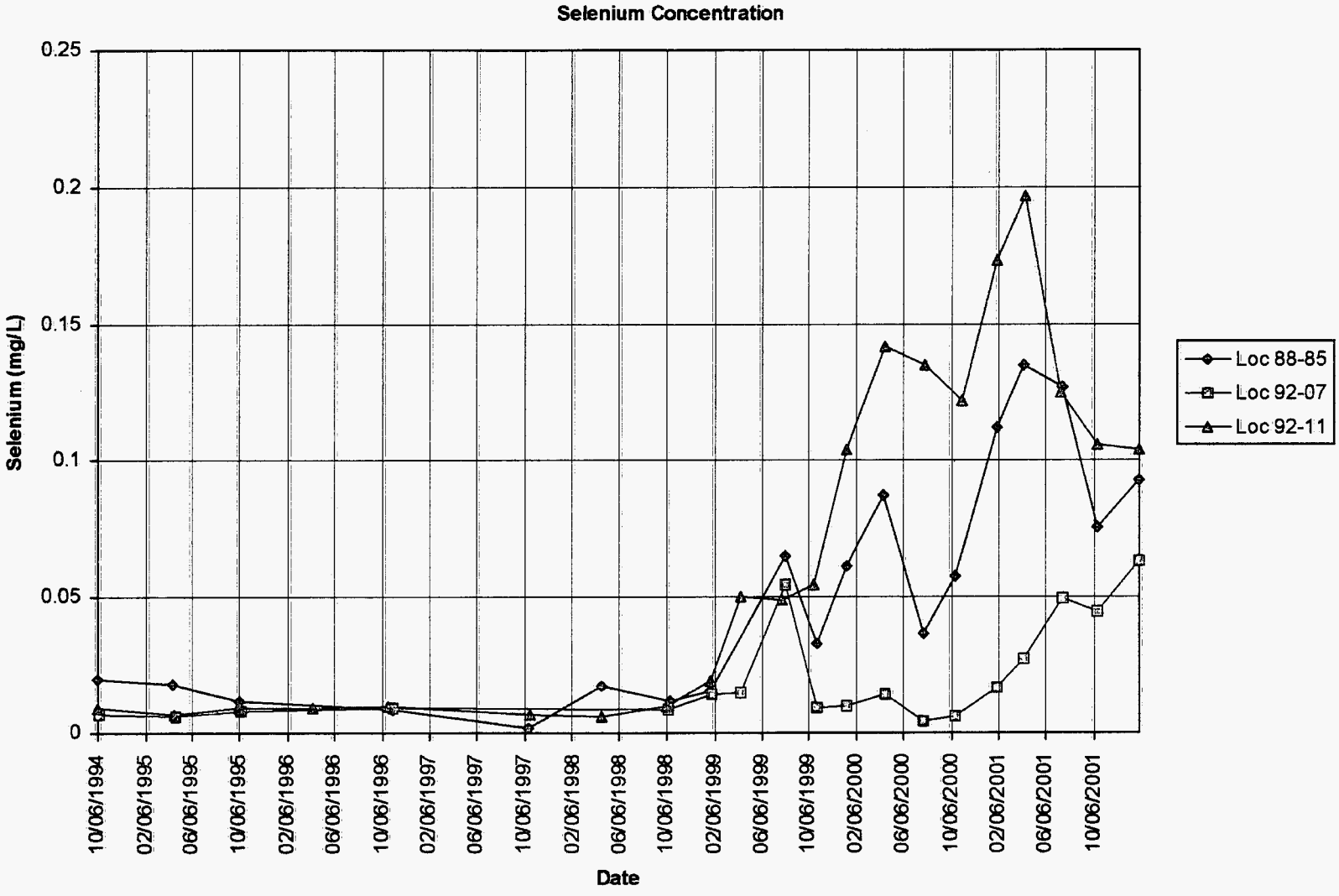


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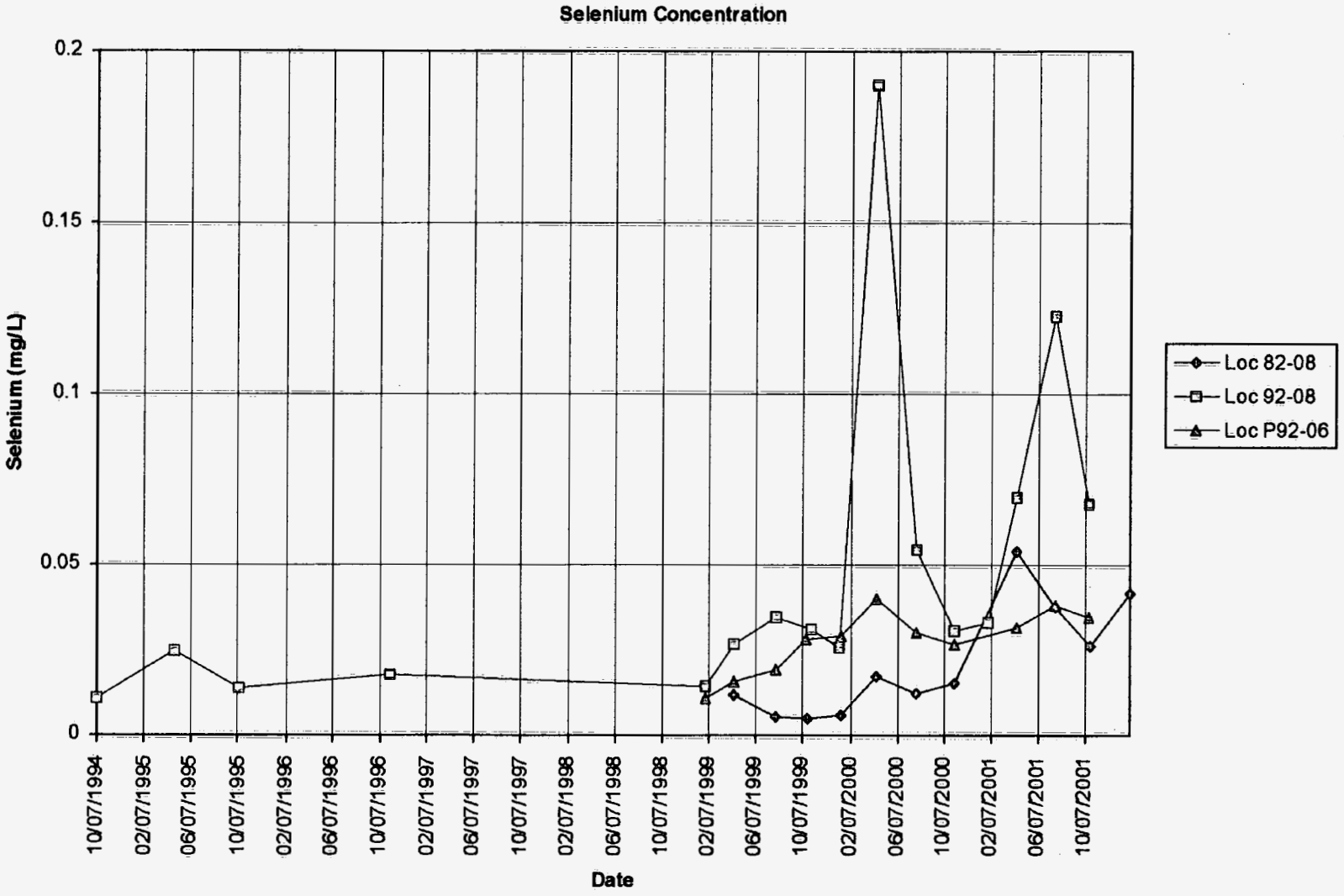
Figure 5



4/9/2002 9:48 am

(3) A Program Directive was prepared in November 2001 after the FFA meeting to sample seeps on and surrounding the millsite. Due to inclement weather it was not possible to sample the seeps until February 2002. The sampling that was performed in February occurred under non-ideal conditions—ponds were either frozen solid or water was under a few inches of ice and some areas that are typically wet were dry or frozen. In addition, snow melt may affect the representativeness of the results. Analytical results for the samples that were collected are

Selenium Concentration (µg/L)	Location
8.7	Seep 1
97.3	Seep 2
129	Seep 3
10.6	Seep 5
17.9	Wetland 3
4.0	Steele Pond
21.6	Culvert at Wetland 2
23.1	Ditch above culvert at Wetland 2
3.9	Pehrson 1 Seep

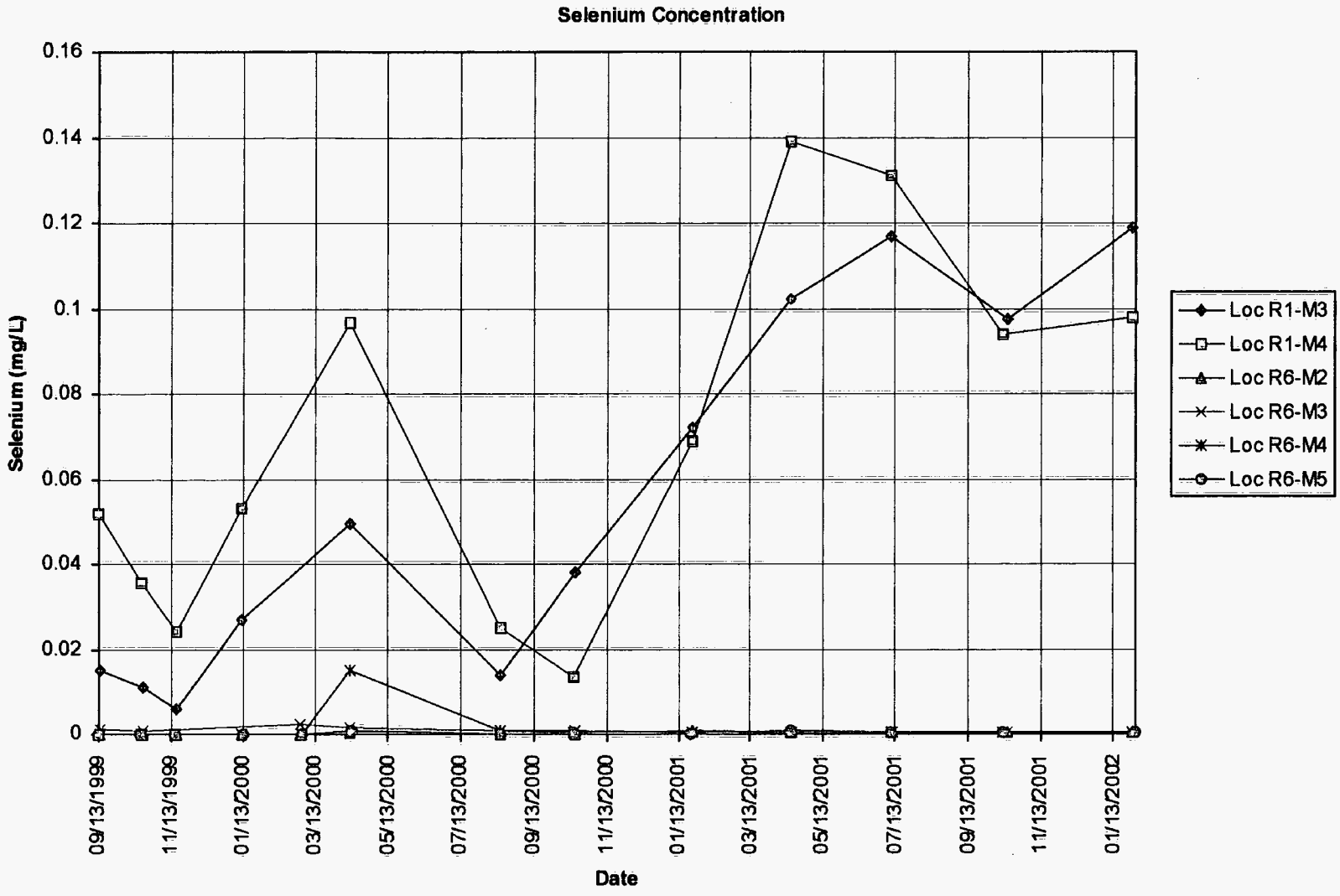
Sample locations are shown on the attached plate showing wetland areas in Monticello. Samples could not be collected at the North Draw near the haul road because the drainage was snow packed or dry. There was no influent to or effluent from Steele's Pond; a hole was broken through the ice to collect the pond sample. The seep entering Sommerville's Pond and the pond itself were dry as were the seeps south of the water treatment lagoons.

The February seep sampling results are consistent with previous results for those sites. Unfortunately, because the dry and/or frozen conditions at some locations precluded sample collection, this sampling effort did not produce data for offsite areas to support the idea that high selenium concentrations occur in surface water in areas not affected by millsite activities.

(4) The effect of the PeRT wall on selenium concentrations is shown in Figure 6. Influent concentrations have fluctuated and ranged from about 70 µg/L to 140 µg/L during the last year. PeRT wall effluent concentrations are generally non detect. The reducing ground water in the Pert wall likely cause selenate (the mobile form of selenium) to be reduced to a ferrous selenide precipitate. The reduction of selenate permanently removes Se from the ground water/surface water system. If, at some future time, significant concentrations of the COCs are detected in the effluent observation wells, options for rejuvenating or removing the reactive media will be discussed with the regulatory agencies.

DOE currently monitors for selenium as part of the routine quarterly sampling rounds. Seeps 1, 2, 3, and 4 and long-term surface water monitoring locations onsite and east to and including the Sorenson site are monitored quarterly. Ground water samples are collected quarterly from monitoring wells onsite and east to well 82-08 and MW00-07. Wells further downgradient are sampled on a variable schedule. DOE anticipates continuing this monitoring schedule through preparation of the ROD and which a time a modified schedule will be proposed to the regulatory agencies.

Figure 6



4/9/2002 10:11 am

Summary

DOE believes that selenium associated with the mill tailings has mostly been removed from the site by tailings remediation, additional sub-pile soils excavation, and water treatment plant operations. Minor amounts of contamination may have existed in ground water aquifer materials on site after surface remediation and there is a residual Se plume offsite (as with other contaminants). Concentrations in offsite ground water were mostly less than 20 µg/L prior to the recent increase.

Selenium concentrations first began to increase at wells 92-11 and 88-85 located immediately offsite in the main channel of the aquifer (see attached plate showing selenium results). The increase began in April 1999, approximately one quarter after increased nitrate concentrations were seen in the same wells. DOE believes that the exposed unweathered surfaces of Mancos Shale and Dakota Sandstone became subject to oxidizing conditions that may have been enhanced by fertilizer application; the oxidizing conditions favored leaching selenium into the aquifer. Release of selenium is a naturally occurring phenomenon when oxidizing water comes in contact with these marine shales. DOE has leached samples of Mancos Shale and Dakota Sandstone Formation collected from the Near South Site (which is unaffected by millsite activities). Selenium concentrations of about 100 µg/L were measured in the leachate.

The time-concentration plot shown in Figure 4 is consistent with this interpretation. Samples from well 92-11 closest to the millsite show the earliest and largest increase in selenium. Selenium levels are expected to naturally attenuate on the millsite as exposed areas of bedrock are now overlain with fill material and fertilizer application using readily soluble forms of nitrogen has ceased; these factors will lead to a decrease in the oxidizing condition of the water rendering selenium less mobile.

Selenium in onsite wells T01-12 and T01-07 that are along the margin of the alluvial flow system may attenuate more slowly than wells within the primary constructed alluvial channel because of elevated levels of selenium in recharge from the north.

DOE believes that selenium concentrations have increased in Montezuma Creek due to the seep water and other channelized surface water flow entering the creek and due to discharge of ground water with elevated levels of selenium. It is difficult to determine the relative importance of each source (surface water flow vs. ground water discharge) and their impact on the timing of the selenium increase because of a number of factors. These factors include:

1) There has been only a 4-5 µg/L increase in selenium in surface water which is relatively small compared to the increase in ground water (compare levels on Figures 2 and 4).
2) Gaining/losing reaches of Montezuma Creek and the magnitude of the gain/loss of each reach are difficult to determine accurately enough to resolve a 4-5 µg/L increase.
3) Run-on flow to the millsite was controlled through restoration and continues to be controlled to some extent. The concentration of selenium in run-on water is not known but has the potential to be elevated; run-on water would be oxidizing and may have elevated nitrate levels. Run-on water is currently channelized and enters Montezuma creek just west of the eastern millsite boundary.

4) Some of the perennial seeps on the millsite have been channelized to some extent and the flow directed to the creek. Construction of the seep channels occurred during restoration to prevent erosion.
5) There have also been at least two episodes of plating the hillside north of Montezuma Creek. The first plating occurred after remediation as an attempt to reduce gross alpha activity measured in the surface water. Some of this material was then re-excavated to reduce the surface elevation in Wetland 3 to meet design specifications.
6) During most of millsite restoration Montezuma Creek flow was piped and diverted in various configurations and did not flow in the reconstructed creek channel until east of the PeRT wall.

Because the subsoils in the Monticello area are in part derived from the Mancos Shale it is expected that they will show variable levels of naturally occurring selenium. DOE believes infiltration of irrigation water used by Monticello residents and leaking City water pipes provide the oxidizing conditions necessary for mobilization of selenium from alluvium and shale residuum on the hillside to the north of the site. Mobilized selenium then enters millsite in the form of seeps and as underflow. The highest concentration of selenium in surface water occurs in Seep 3 near the northeastern corner of the millsite.

Seasonal irrigation with the possibility of other added oxidants such as nitrate and phosphate is expected to prolong the leaching of selenium in Mancos residuum because of the cycling of ox/redox conditions. Selenium leached from the bedrock on the millsite is expected to attenuate more quickly than seeps along the hillside north of the site because backfilling and the creation of wetlands will create more stable redox conditions.

Recommendation

The well documented theory that the Mancos Shale/Dakota Sandstone contains releasable selenium under oxidizing conditions is substantiated by increasing selenium levels at Monticello post millsite remediation. DOE proposes to drop selenium from the list of COCs in terms of compliance or achievement of MCLs. DOE proposes to monitor for the selenium in surface water and ground water to document future changes in concentrations. Based on the current analysis of the data, the levels of selenium measured in Seep 3 and by extension Seep 2, are expected to fluctuate widely and to remain high for some time to come.

Cemetery Road
Clay Hill Drive
Surprise #1 Seep
Mule Deer Seep
Ghost House Seep
Upper Seep
Spot Seep
Pumphouse 1 Seep
Pumphouse 2 Seeps
Surprise #2 Seep
Lower Southwest Seep
Steele Pond
Upper North Drainage
Central Tract Wetland
Monticello Cemetery
Cemetery Seep
Tiny Seep
Wood Pile Seep
Tree Seep 1
Tree Seep 2
Tree Seep 3
Pehrson 1 Seep
Groundwater Drainage 2
Hill Side Spring
Below Pond
Stock Pond
Hillside Far East Seep
Hillside East Seep
Ditch
Rip-rapped Channel
Drainage
Staging Area
Seep 3
Goodknight Spring
Creek View Seep
Seep Channel
DRAINAGE
Flat Seep
Highway Seep
Seep Pond
Seep 5
GRAVEL CIRCLE
Culvert
Weir
Backwater Wetland #2
SW01-03
NO SURFACE FLOW (~50')
NO SURFACE FLOW (~200')
SW01-02
Montezuma Creek
Cliff Seep
WILLOW WATTLES PLANTED
Monticello Millsite
Backwater Wetland #1
Rip-rapped Channels
T01-28 Junior Seep
T01-27 Seep
T01-28 Seep Seep
Seep 4
Seep 1
Seep 2
Backwater Wetland #3
SW00-02
ROAD CROSSING
CULVERT
DROP STRUCTURE
SW01-01
Rock Outcrop
Deer Draw
Reclaimed Haul Road Corridor
Hill Side Seep
SW92-03
SW00-01
SW00-03
Below Lake West
Stock Pond
North Draw
Haul Road Wetland
Pond
South Depression
Edge of Pond

198
178-PH-I
983
982
1006
986
961
1103
963
178-PH-IIA
144
143
167
108
178-PH-II
182
176
957
1078
178-PH-III
177
175
956
145
180-PH-II
180-PH-I
178-PH-IIA
178-PH-II
178-PH-IIA
845
178-PH-III
178-PH-III
205
178-PH-II
211-PH-I
211-PH-II
181-PH-III
181-PH-IVA
950
988
1001
179-PH-IIB
1083
891
179-PH-IV
179-PH-III
886
1084
391-PH-IV
1020
888
236
105-PH-I
391-PH-II
887
391-PH-I
951
884
105
391-PH-III
105-PH-II
990
1081
999
1040
1041
1042

Legend
- Wetlands Restored in 1995
- Wetlands Restored in 1997
- Wetlands Restored in 1998
- Wetlands Restored in 1999
- Wetlands Restored in 2000
- Wetlands Restored in 2001
- Unaffected Wetland Area Used for Baseline Measurements
- New Wetlands in Post-Remedial Areas
- 951 Property Number
- ★ Surface Water Monitoring Location
- Seep Channel
- Drainage
- Rip-rapped Channels

N
SCALE IN FEET
250 125 0 250 500 750

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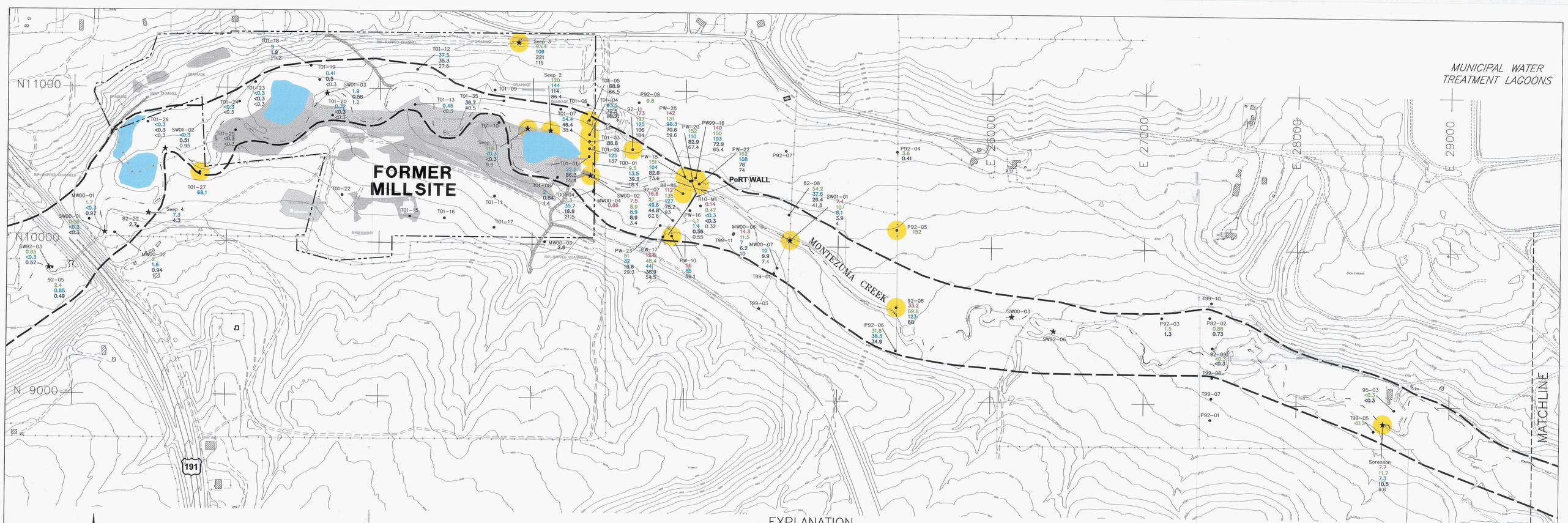
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO

Site Map Showing Baseline, Restored, and New Wetland Areas in Monticello

DATE PREPARED: April 4, 2002
FILENAME: Q0027300

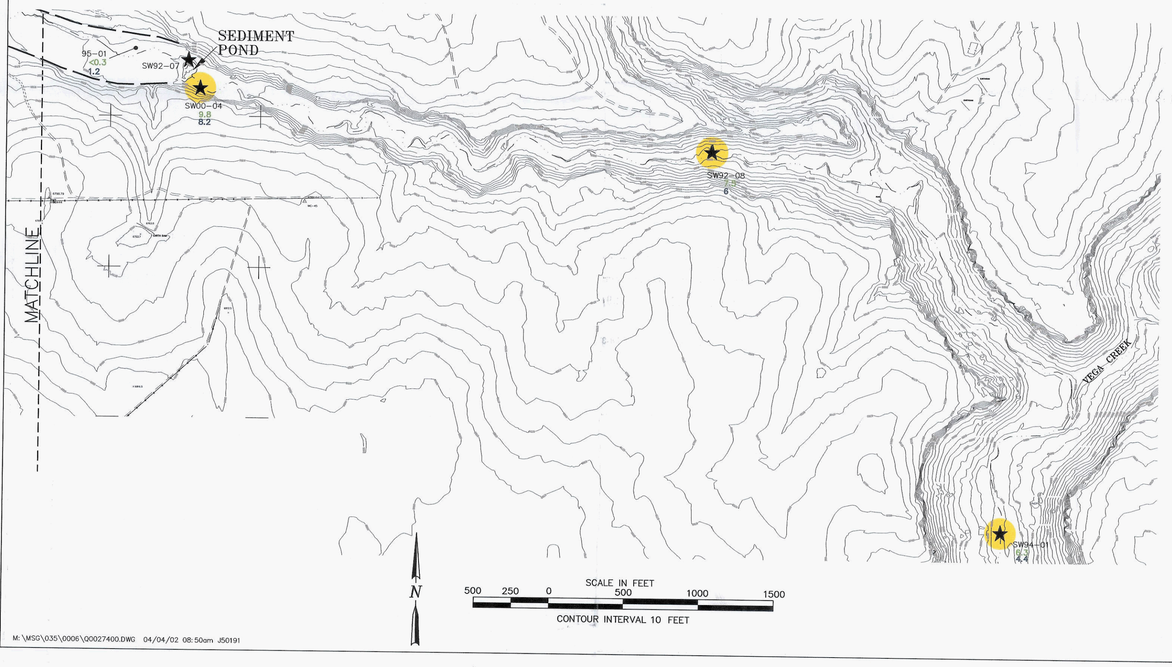


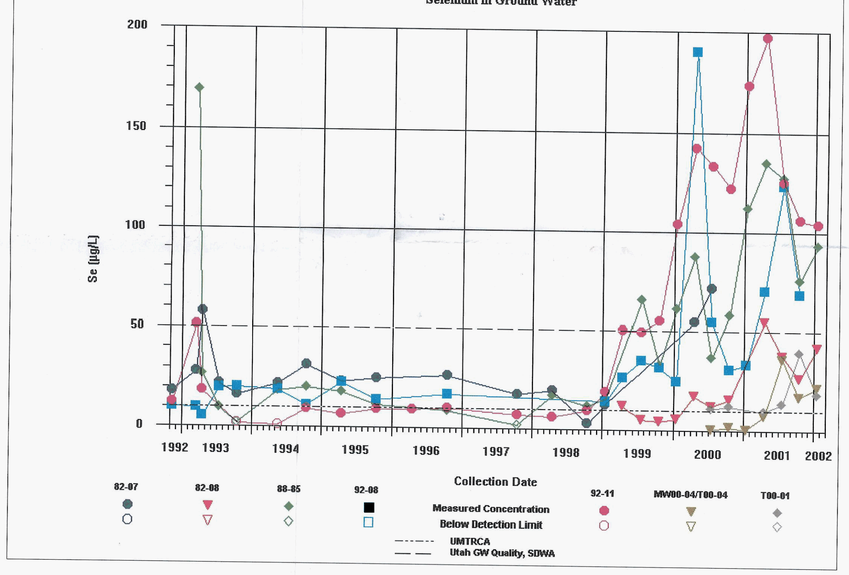
N

SCALE IN FEET
300 150 0 300 600 900
CONTOUR INTERVAL 10 FEET

EXPLANATION

- ★ SURFACE WATER LOCATION
- • ALLUVIAL GROUND WATER MONITORING WELL
- SELENIUM CONCENTRATION µg/L
  - 173 JANUARY 2001 DATA
  - 197 APRIL 2001 DATA
  - 125 JULY 2001 DATA
  - 106 OCTOBER 2001 DATA
  - 104 JANUARY 2002 DATA
- LOCATIONS WHERE THE UTAH STANDARDS ARE TYPICALLY EXCEEDED
- MILLSITE BOUNDARY
- APPROXIMATE EXTENT OF ALLUVIAL AQUIFER
- NEW WETLAND AREA
- BEDROCK AREAS
- SEEP CHANNEL
- DRAINAGE
- RIP-RAPPED CHANNELS





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SELENIUM RESULTS FOR 2001 AND JANUARY 2002

DATE PREPARED: APRIL 4, 2002

FILENAME: Q0027400

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